TECHNICAL REPORT NO. TR-755

IMPROVING LAND ARMAMENTS: LESSONS FROM THE BALKANS

THE U.S. ARMY EFFORT [ABBREVIATED]

SEPTEMBER 2004

U.S. ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY
ABERDEEN PROVING GROUND, MARYLAND 21005-5071

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This technical report documents the U.S. Army effort in support of the North Atlantic Treaty Organization's (NATO) study entitled "Improving Land Armaments: Lessons From The Balkans." The study objective was to identify and then synthesize individual NATO nation land equipment lessons related to multinational interoperability. The theater of interest was the Balkans (e.g., Bosnia, Kosovo and Former Yugoslavian Republic of Macedonia) in the 1995 – 2001 timeframe. The final synthesized product, a NATO report, is intended to be a resource for NATO and Partnership for Peace (PfP) nations to make future coalition operations more efficient and effective. The study was conducted during the summer and fall of 2001.

This document, TR-755**,** was constructed in support of the Defense Analysis Seminar XII, Seoul, Republic of Korea, April 2004. It is an abridged version of AMSAA Technical Report #703 (TR-703), *Improving Land Armaments: Lessons from the Balkans - The U.S. Army Effort,* May 2002. TR-755 is an abbreviated version of TR-703 to allow for Public Release. The TR-703 includes additional detail, the final NATO report, and the U.S. Only lessons. TR-703 is unclassified, but restricted For Official Use Only.

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CONTENTS

LIST OF FIGURES

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LIST OF ACRONYMS

A

ACE	Allied Command Europe
ADAMS	Allied Deployment and Movement System
AFV	Armored Fighting Vehicle
AOR	Area of Responsibility
APC	Armored Personnel Carrier
APFSDS	Armored Piercing Fin Stabilized Discarding Sabot
ARRC	Allied Command Europe (ACE) Rapid Reaction Corps
ARTY	Artillery
AT	Anti-Tank
ATACMS	Army Tactical Missile System

B

BDA	Battlefield Damage Assessment
BDI	Balkans Digitization Initiative
BN	Battalion

C

CA	Canada
CAS	Close Air Support
CBA	Combat Body Armour
CCD	Camouflage, Concealment and Deception
CIMIC	Civil-Military Co-operation
COIN	Counter Insurgency
COTS	Commercial-Off-The-Shelf
CP	Control Point
CRONOS	Crisis Response Operation NATO Open System

D

DE	Denmark
DODAAC	Department of Defense Activity Address Code

E

ECI	Expeditionary Campaign Infrastructure
ES	Equipment Support

F

FAC	Forward Air Controller
FMS	Foreign Military Sales
FR	France
FSB	Forward Support Battalion

G

GE	Germany
GPS	Global Positioning System

H

HET	Heavy Equipment Transporter
HEMTT	Heavy Expanded Mobility Tactical Truck
HHRAM	Harm Homing Radiation Anti-Missile
HLS	Helicopter Landing Sites
HMMWV	High Mobility Multi-purpose Wheeled Vehicle
HQ	Headquarters
HU	Hungary
HUMINT	Human Intelligence

I

IARRCIS	Interim ARRC Information System
ID	Identification
IFOR	Implementation Force
IFR	Instrument Flight Rules
ISTAR	Intelligence, Surveillance, Target Acquisition and Reconnaissance
ISL	Institute of Saint-Louis, France
IT	Information Technology

J

JOPES	Joint Operation Planning and Execution System
Joint STARS	Joint Surveillance Target Attack Radar System

L

LAMS	Large Aviation Maintenance Shelters
LAR	Logistics Assistance Representative
LAW	Light Anti-Tank Weapon
LOCE	Linked Operational Capability Europe

LTC	Lieutenant Colonel

M

MANPADS	Man-Portable Air Defense System
MBLU	Mobile Bath and Laundry Units
MBT	Main Battle Tank
MCP	Mobile Check Point
MEDEVAC	Medical Evacuation
MHE	Materiel Handling Equipment
MILVANS	Military-Owned Demountable Container
MLRS	Multiple Launch Rocket System
MSR	Main Supply Route
MTW	Major Theatre of War

N

NAAG	NATO Army Armaments Group
NACOSA	NATO Communication and Information System Operating and Supporting Agency
NAMSA	NATO Maintenance and Supply Agency
NATO	North Atlantic Treaty Organization
NBC	Nuclear, Biological and Chemical
NC3B	NATO Consultation, Command and Control Board
NL	Netherlands
NLW	Non Lethal Weapons
NR	NATO Restricted
NU/PfP	NATO PfP Unclassified

P

PADS	Position Azimuth Determining System
PLS	Palletized Load System
PfP	Partnership for Peace
PLGR	Precision Lightweight GPS Receiver
PSO	Peace Support Operations
PO	Poland

R

ROE	Rules of Engagement
ROTA	Release Other Than Attack
RTO	Research and Technology Organization (part of NATO)

S

SAS	Studies, Analysis and Simulation
SHAPE	Supreme Headquarters Allied Powers Europe
SINCGARS	Single Channel Ground and Airborne Radio System
SNIC	Snow and Ice Clearance
SOF	Special Operations Forces
SOP	Standing Operational Procedures
STANAG	Standardization Agreement
STU	Secure Telephone Unit

T

TF	Task Force
TIC	Toxic Industrial Chemicals
TO&E	Table of Organization and Equipment
TTP	Tactics, Techniques and Procedures

U

UAV	Unmanned Air Vehicle
UK	United Kingdom
UN	United Nations
UNPROFOR	United Nations Provisionary Force
UOR	Urgent Operational Requirements
UPS	Uninterruptible Power Supply
US	United States
(U/U)	Unclassified/Unlimited
UXO	Unexploded Ordnance

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"Those who do not remember the past are condemned to repeat it." **- George Santayana, Spanish-American Philosopher**

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1. INTRODUCTION

This report documents the U.S. Army effort in support of the North Atlantic Treaty Organization's (NATO) study entitled "Improving Land Armaments: Lessons From The Balkans." The study objective was to identify and then synthesize individual NATO nation equipment lessons related to multinational interoperability. Accordingly, our focus was on materiel lessons; we did not search for lessons that were doctrinal, operational, training, or tactical in nature. The theater of interest was the Balkans (e.g., Bosnia, Kosovo and Former Yugoslavian Republic of Macedonia) in the 1995 – 2001 timeframe. The final synthesized product, a NATO report is intended to be a resource for NATO and Partnership for Peace (PfP) nations to make future coalition operations more efficient and effective.

In early 2001, the NATO Army Armaments Group (NAAG) requested that the NATO Research and Technology Organization (RTO) perform a study, within one year, examining Balkan land armament lessons in order to better support and conduct future operations of a similar nature. The study request was accepted and an RTO Studies, Analysis and Simulation (SAS) Panel was formed to guide the multinational effort (i.e., SAS-041). This effort was based on a similar study, SAS-031, Military Application Study on Lessons Learned from Allied Force Operations that concentrated mainly on the Air Force aspects of recent NATO actions in Kosovo.

Headquarters Department of the Army (DA) agreed to support the study and directed the Army Materiel Systems Analysis Activity (AMSAA) to lead and conduct the U.S. Army's effort. In all, eight NATO countries supported the study and are identified as follows:

- Canada
- Denmark
- France
- Germany
- Hungary
- Netherlands
- United Kingdom
- United States

From 2-3 April 2001, a planning/kick-off meeting was held at NATO Headquarters, Brussels, Belgium, for the participating nations. This meeting resulted in guidance for six

months of work by each participating country. The guidance included a study taxonomy, identification of possible sources for lessons, and discouragement from pursuit of new data collection. It was also agreed that the study would culminate with a single Synthesis Workshop to be held at the French-German Research Institute of Saint-Louis (ISL), France, 22-31 October 2001. The workshop was designed to complete the study within the NAAG's mandated one-year timeframe.

The workshop was successfully concluded with the results being presented to the NAAG on 12 December 2001. According to the study's NATO lead, the NAAG was extremely pleased with the results and the overall effort. In addition, the NAAG desired to release the results to the PfP nations. NATO is planning a spring 2002 workshop to share the results with the PfP nations and to collect lessons from their Balkan experiences.

2. CAVEATS

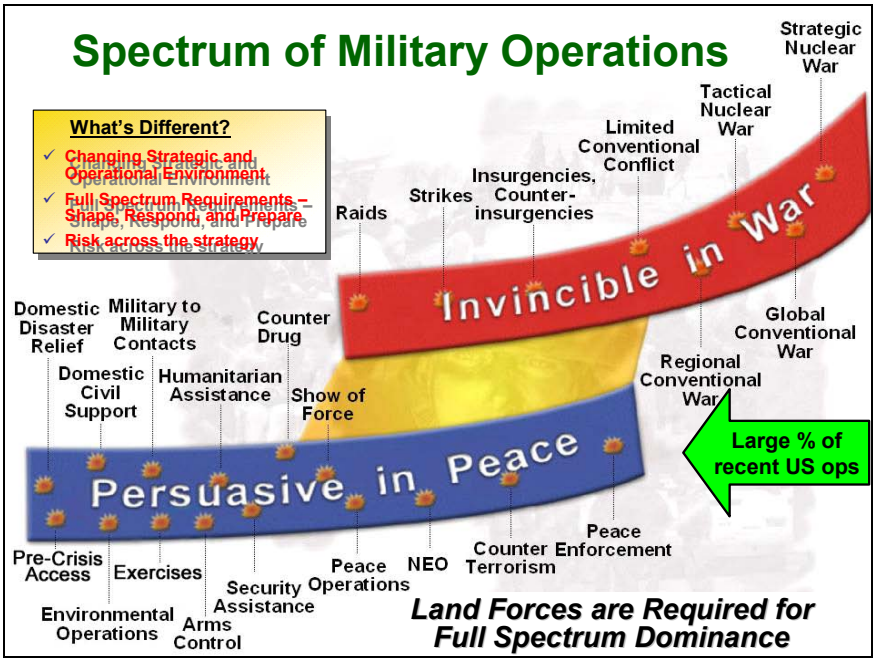

Figure 1. Context of Lessons Learned.

Army land operations in the Balkans provided a good environment for learning multinational lessons emanating from peace support operations. Much was learned, for example, about multinational interoperability in the areas of communications and logistics sustainability. Some of the lessons, however, might have been different had they occurred in a pure warfighting environment or if the operation had been of higher intensity. At the same time, it should be noted that warfighting operations (e.g., Major Theater of War (MTW)), had they occurred, would have provided the opportunity for additional lessons (e.g., armor protection, tank main armaments, etc.) and different lessons (e.g., different communications traffic loads, different maintenance on combat vehicles due to increased operational tempo, battle damage, etc.). Figure 1 depicts the spectrum of military operations from which the lessons were generated – Peacekeeping Operations. To reemphasize, if the lessons had been obtained from operations that originated from the "Invincible in War" vicinity of the chart, then different lessons would likely have been generated.

While NATO's study report may include some non-materiel lessons (e.g., doctrinal, operational, and tactical lessons), it should be noted that AMSAA excluded non-materiel lessons from study consideration. The study scope, as defined by NATO, focused on materiel related interoperability issues, thus the non-materiel issues were excluded. On a similar note, while the NATO report includes some national-only lessons (i.e., lessons dealing with a single nation's equipment, but not related to multinational interoperability), AMSAA did not intentionally seek out U.S.-only lessons per the study scope. As part of the research process, AMSAA did accumulate a number of U.S.-only lessons that will be of interest to DA. The U.S.-only lessons were not provided to the NATO study partners due to the sensitivity of the lessons.

3. METHODOLOGY

3.1 U.S. Army Methodology. In order to support the October 2001 Synthesis Workshop, AMSAA pursued a multi-faceted approach to develop lessons. The investigative methods included literature research (e.g., After-Action Reports), interviews (e.g., those with Balkans experience), lessons learned data base explorations (e.g., Center for Army Lessons Learned), organization requests (e.g., Army Materiel Command – Europe) and an AMSAA-created web-based data collection system allowing the submission of on-line lessons. To assist with the large amount of data collected and to support the workshop, AMSAA created a data base tool (in Microsoft Access 2002) to allow for ease of data usage and collaboration. The data base tool was a significant development and was critical to the study conduct due to the number of lessons that were generated by the team.

On 20 September 01, AMSAA delivered just over 300 lessons to DA. Approximately 40 percent of the lessons were identified as multinational with the remainder considered as U.S.-only. Multinational lessons were those lessons that were materiel in nature and incorporated an interoperability issue between the U.S. Army and a NATO/PfP military force. The U.S.-only issues were materiel items that were, as the name implies, focused strictly on U.S. Army lessons and not necessarily interoperability-related. Again, we did not search for non-materiel lessons (e.g., doctrinal and training related). DA reviewed the package for release to the NATO Synthesis Workshop. These lessons were presented to the workshop. The U.S.-only lessons were not released to the Synthesis Workshop due to their sensitive nature. Per DA request, AMSAA assessed a level of confidence in the source information for each lesson. In addition, AMSAA assessed the level of impact to cost, performance, and supportability for each lesson. While these assessments were made available to the NATO Synthesis Workshop, the NATO Study Group decided to exclude the assessments since the operation was only performed by the U.S. delegation. These assessments are, however, included within the U.S.-derived.

Top-level guidance for the study included a mandate to minimize new data collection, primarily to avoid turbulence to field units. There were anecdotal reports from field commanders indicating that some had been interviewed as many as nine times by nine different organizations. In order to comply with the guidance, AMSAA focused its attention on identifying existing sources and then harvesting available data. The only exception was that AMSAA created a government-accessible web site through which individuals could voluntarily enter lessons or data regarding lessons.

As AMSAA began to identify existing data sources, attention was focused on sources believed to offer positive aspects in the following categories:

- Availability
- Accessibility
- Accuracy

The data sources can be grouped logically into data bases and libraries, documents, and agencies.

Data Bases and Libraries: Several online resources were identified as being useful research tools. These included, but were not limited to, the data bases and libraries as follows:

- Department of Defense Joint Forces Command, Joint Warfighting Center, Joint Center for Lessons Learned (JCLL), Suffolk, VA – JCLL maintains a joint data base and library providing information centering around U.S. joint operations.

- U.S. Army Training and Doctrine Command, Center for Army Lessons Learned (CALL), Ft. Leavenworth, Kansas – CALL resources provided many useful data points (e.g., specific lessons and full text reports), but are focused more on operational / doctrinal type issues.

- U.S. Army Europe, Operations, Plans, and Training Analysis Branch (OPTAB), Heidelberg, Germany – OPTAB's primary resource is the data base and libraries referred to as the USAREUR Lessons Learned Operating System (ULLOS); ULLOS was useful in providing many leads to lessons and reports from USAREUR and other units that had participated in the Balkans theater.

AMSAA would like to note that the staffs of each of these three organizations were quite helpful in assisting our analysts in the research.

Documents: Specific documents that were identified included:

- NATO and U.S. Operations Relating to Kosovo - 1998-1999, RAND. While much of this report focused on the air campaign, it did contain some vignettes about ground-based equipment (e.g., Firefinder counterbattery radar) and aerial reconnaissance (e.g., Guardrail Common Sensor and Unmanned Aerial Vehicles)

- Operation "Allied Force" Lessons Synthesis Study Report, NATO. This report documents the activities and findings of the NATO study that was given to AMSAA as a model to follow. The study focused on the air campaign.

- Defense Capabilities Initiative (DCI) – Compendium of DCI Decisions, Revision 11, NATO**.** This report describes the ongoing NATO initiative to develop better joint capabilities across all functional areas. In the words of NATO Secretary General Lord Robertson: *"The Defense Capabilities Initiative is designed to ensure that all Allies not only remain interoperable, but that they also improve and update their capabilities to face the new security challenges."* The identification of these needs helped to focus our effort on where we might find lessons ripe for harvest.

General categories of reports included unit After-Action Reports (AARs), Post-Exercise Reports (PXRs), and lessons learned publications from the JCLL, USAREUR ULLOS and CALL. Many documents of this nature were reviewed by the AMSAA team.

The U.S. Army has a long-standing practice of having its units develop AARs and PXRs immediately following an action, a deployment, or a training exercise. For example, NATO

Joint Headquarters periodically conducts and documents interoperability exercises in areas such as signal, logistics, and engineering. AMSAA tried with some success to acquire historical AARs for units that rotated through the Balkan theater and PXRs from recent exercises. A small subset of the AARs, PXRs and lessons learned publications examined are as follows:

- 49th Armored Division Stabilization Force (SFOR) 7 AAR
- CALL News From The Front Bulletin (multiple issues)
- Exercise Clever Fix 1999 – Final Exercise Report
- Exercise Collective Effort 1998 – PXR
- Combined Endeavor 2000 Executive Report
- 5th Signal Command - Operation Joint Endeavour Lessons Learned Book
- USAREUR DCSLOG - Balkans Logistics Lessons Learned
- General Accounting Office - Mine Detection: Army Detector's Ability to Find Low-Metal Mines Not Clearly Demonstrated
- Center for Strategic and International Studies - The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo
- USAREUR Operation Joint Endeavor AAR
- USAREUR Operation Joint Forge AAR
- USAREUR Operation Joint Guard AAR
- Various AARs from SFOR 5-8

Agencies: AMSAA contacted numerous agencies and organizations. These included various U.S. Army Program Executive Officer (PEO)/Project/Product Manager (PM) offices (e.g., PM MILSATCOM, PM Apache), U.S. Army schools (e.g., Engineer School, Intelligence Center & School, etc.), U.S. Army Materiel Command (AMC) Major Subordinate Commands, AMC-Europe, AMC-Field Assistance for Science and Technology (AMC-FAST), the U.S. Army Peacekeeping Institute (PKI), and U.S. Army Europe.

Finally, soldiers were one of our best sources although the number of soldiers interviewed was limited. AMSAA received first-hand, high quality input from the dedicated men and women of the Balkans theater.

Synthesis Workshop Methodology. At the April 2001 planning meeting, a study taxonomy was developed. Each country was instructed to address all chapters while generating lessons. The taxonomy is comprised of the five chapters as follows:

- Mobility, Countermobility, and Survivability
- Fires and Counterfire
- Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR)
- Deployment and Sustainability
- Miscellaneous

At the October 2001 workshop, the eight participating countries provided land lessons based on their Balkan experiences relative to the specified five-chapter outline. The NATO

report summarizes the synthesized findings and lessons. Where duplicative lessons occurred between countries, the lessons were combined to better state the issue. Figure 2 identifies the individual chapters, sub-chapters, and their associated country leads. While developing lessons for all chapters, AMSAA led the C4ISR chapter synthesis as well as seven other sub-chapters as follows:

- Mobility
- Countermobility
- Communications
- Surveillance and Counter-Surveillance (with ISL assistance)
- Reconnaissance (with ISL assistance)
- Maintenance
- Transport

The methodology of the October 2001 Synthesis Workshop is illustrated by three main phases:

- National and NATO organization input
- Synthesis activities
  - Internal sub-chapter synthesis
  - Sub-Chapters synthesis within a chapter
  - Chapter synthesis involving all chapters
- Final document preparation

The national presentations were held in plenary sessions. The presentations had a mixture of classifications up to and including NATO Restricted. The briefings were structured according to the taxonomy, which greatly facilitated the synthesis process. Following the completion of the briefing sessions, the Sub-chapter and Chapter Leaders drafted a summary for their specific topics. In order to ensure that the sub-Chapter and Chapter syntheses reflected the views of all participants, several feedback presentations took place. The lessons were individually classified according to the national classification.

An Editorial Party then continued working to complete the chapter synthesis, the cross-chapter synthesis and the wording of the final report. A crosswalk of each lesson to each chapter was generated by the AMSAA team and was included in the final NATO report. The crosswalk should be useful, both to NATO and to individual countries, as various organizations attempt to map lessons learned to possible materiel solutions.

1.0 Mobility, Countermobility & Survivability (UK)

1.1 Mobility (US)
- 1.1.1 Combat and support
- 1.1.2 Combat engineering
- 1.1.3 Helicopters

1.2 Countermobility (US)
- 1.2.1 Combat engineering

1.3 Survivability (UK)
- 1.3.1 NBC defense
- 1.3.2 Vehicle protection
- 1.3.3 Personnel protection
- 1.3.4 Camouflage
- 1.3.5 Force protection

2.0 Fires and Counterfire (GE)

2.1 Non-Lethal Weapons (NLW) (FR)
2.2 Weapon systems (DK)
2.3 Collateral damage (GE)
2.4 Impact of rules of engagement on equipment (UK)
2.5 Ammunition

3.0 C4ISR (US)

3.1 Communications (US)
3.2 Surveillance and counter-surveillance (US/ISL)
3.3 Command and control systems (SHAPE)
3.4 Reconnaissance (US/ISL)
3.5 Information operations (EW, media ops, psyops) (FR)

4.0 Deployment & Sustainability (DK)

4.1 Logistics (GE)
4.2 Maintenance (US)
4.3 Storage and supply (DK)
4.4 Transport (includes movement control) (US)
4.5 Medical equipment (UK)
4.6 Accommodation (NL)
4.7 Infrastructure (NL)
4.8 Local procurement and contracting (FR)
4.9 Non-organizational equipment (use of civ. equipment)

5.0 Miscellaneous (NL)

5.1 Impact from environment (weather, terrain) (CA)
5.2 Impact on environment (DU,…) (GE)
5.3 Joint aspects (SHAPE)
5.4 Training and simulation (CA)
5.5 Ergonomy (NL)

() - Lead synthesis nation (chapter lead)
() - Country to assist lead synthesis nation w/ report writing (sub-chapter lead)
(US) - US effort

Figure 2. Expanded Study Taxonomy with Lead Nations Identified.

4. U.S. FINDINGS

As noted earlier, AMSAA delivered approximately 300 lessons to DA in September 2001. These lessons were a mix of "U.S.-only" (i.e., lessons involving only U.S. equipment) and "multinational" (i.e., lessons involving U.S. equipment and another NATO nation's equipment). Figure 3 graphically summarizes the categorization across chapters of lessons that were generated for the study. Given that the Balkans mission was a peacekeeping mission, one would expect few firepower lessons, and that indeed was the case. As expected, many lessons were generated in the categories of mobility and logistics. Maneuvering within the Balkans countryside was difficult and this was reflected in the generated lessons. There were also numerous logistics issues brought to the forefront, and this was also to be expected since the mission required an enormous amount of logistical support. The category where the greatest numbers of lessons were created was in C4ISR. With the multitude of countries supporting the effort, one can imagine the difficulties that arose in attempting to communicate between the various national units.

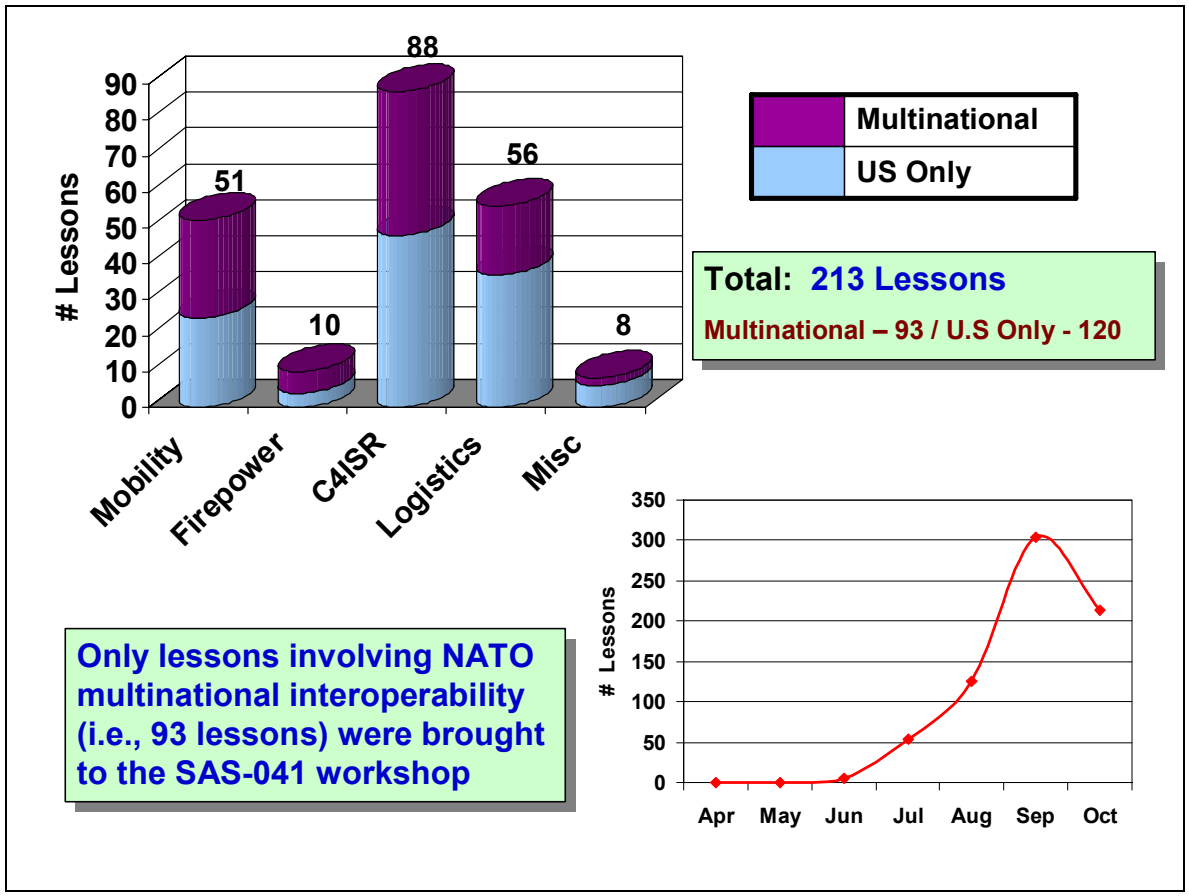

Figure 3. Statistics on U.S. Lessons.

Certainty	Description
Low	Single undocumented source
Medium	Multiple observations, not officially documented
High	Documented in official report

Figure 4. Certainty Level Description.

A total of 93 multinational lessons were presented at the SAS-041 workshop. U.S. Only related lessons equated to 120, and one additional multinational lesson was developed after the workshop. A total of 214 lessons were generated at the end of the U.S. data collection effort. As noted earlier, over 300 lessons were originally provided to DA for release review. These lessons were "rough" in nature and had not been through a stringent review process. This was necessary to meet the DA review process and SAS-041 schedule deadlines. As time allowed, the 300+ lessons were reviewed in much greater detail. Duplicate and related lessons were combined. Lessons that were doctrinal in nature were discarded. Eventually, the 300+ lessons were reduced to the 214 unique lessons noted above. The lower right corner of Figure 3 illustrates this process of generating lessons with the eventual reduction thereof due to refinement. The AMSAA data base was a critical tool for the refinement process as it allowed the easy review and manipulation of the lessons. The next two sections provide an overview of some of the more significant findings of the U.S. study.

It should be noted that a lesson's authenticity and current status received only cursory review during the study. It was determined early-on that these factors would be considered "study limitations." AMSAA gained lessons from many sources, but concentrated heavily on approved exercise and test reports. This in turn bolstered the likelihood of a lesson being authentic. With respect to the lesson's current status or validity, the ability to investigate each lesson, within the mandatory timeframe, would have required far greater human resources than were available. The impact of these limitations was considered minimal, as the goal was to collect as many lessons as possible in the allotted timeframe. In any event, if a particular lesson was found worthy of further investigation, then its present status could be easily obtained on a case by case basis. In addition, this effort did not attempt to suggest solutions for the lessons generated; nor did it strive to do so.

AMSAA assessed a certainty level for each U.S.-generated lesson. Figure 4 defines the various levels of certainty. For example, if a lesson was obtained from a single undocumented source, such as a soldier interview, then the lesson received the lowest possible level of certainty. This by no means suggests that the lesson from such a source is considered suspect; it simply means that there is greater confidence in a lesson derived from a report that has received formal staffing and review than one derived from the point of view of a single source. The ratings are designed to give the reader a quick idea as to the type of source that was used to generate the lesson.

In addition to certainty, AMSAA attempted to score each lesson relative to it level of impact on the force. Figure 5 identifies the levels of impact considered. Impact upon cost, performance and/or supportability were compared to the magnitude of the U.S. forces affected (i.e., narrow, moderate, or broad). While level of certainty was solidly determined based on the particular type of source that generated the lesson, significance determination was a much more subjective effort. The subjectivity was considered a minor limitation, since the benefit of the significance rating was to key the user (i.e., DA) to potentially higher priority problems. The user would make the eventual determination as to what should or should not be pursued and the priority thereof. The AMSAA ratings were created to assist with that effort. The ratings are defined in Figure 5. For example, if a lesson is rated as a "Medium" impact with an associated scope rating of "Broad", then the overall significance rating, given the combination of impact and scope, is "High".

Impact (Cost / Performance / Supportability)	Scope		
	Narrow (one unit or unit type)	Moderate (some unit or unit types)	Broad (many units or unit types)
Low	Low	Low	Medium
Medium	Medium	Medium	High
High	High	High	High

Figure 5. Significance Levels.

Figure 6 identifies the overall statistics relative to assessed certainty and significance lessons. In the majority of cases, the certainty level of the data was considered high. This is a reflection that most of the collected lessons were obtained from AARs and PXRs that went through a formal review process. In actuality, AMSAA desired more data sources, even at the low certainty level. This seems like an odd statement, but one must recall that the definition used for low certainty addresses those lessons obtained from individual soldiers and have not received formal organization review. Since the study intentionally called for no new data collection, this limited the amount of Balkans-experienced soldiers that were interviewed. The candid lessons expressed by individual soldiers produced some interesting lessons.

The certainty level between U.S. Only and Multinational lessons are evenly split. Of the categories that produced the greatest number of lessons, C4ISR produced the greatest number of high significance rated lessons (i.e., Mobility (18), C4ISR (41), and Logistics (18)). This in turn highlights the many difficulties experienced by the allies in attempting to communicate and perform surveillance/reconnaissance activities within the Balkans. This by no means reduces the impact of the lessons experienced in these other categories, but it does highlight the fact much work is needed in the C4ISR area.

U.S.-Generated Multinational Lessons. This section focuses on the heart of the U.S. study effort – Interoperability lessons involving NATO land forces operating in the Balkans. The lessons were wide ranging, but mobility, C4ISR, and support produced the greatest number of lessons. Given the peacekeeping role of the land units, this certainly was to be expected. If the mission had been one of a ground offense, then multinational fire and counterfire would likely have played a much greater role in the development of lessons. The following section summarizes U.S. generated lessons that fall into the multinational category.

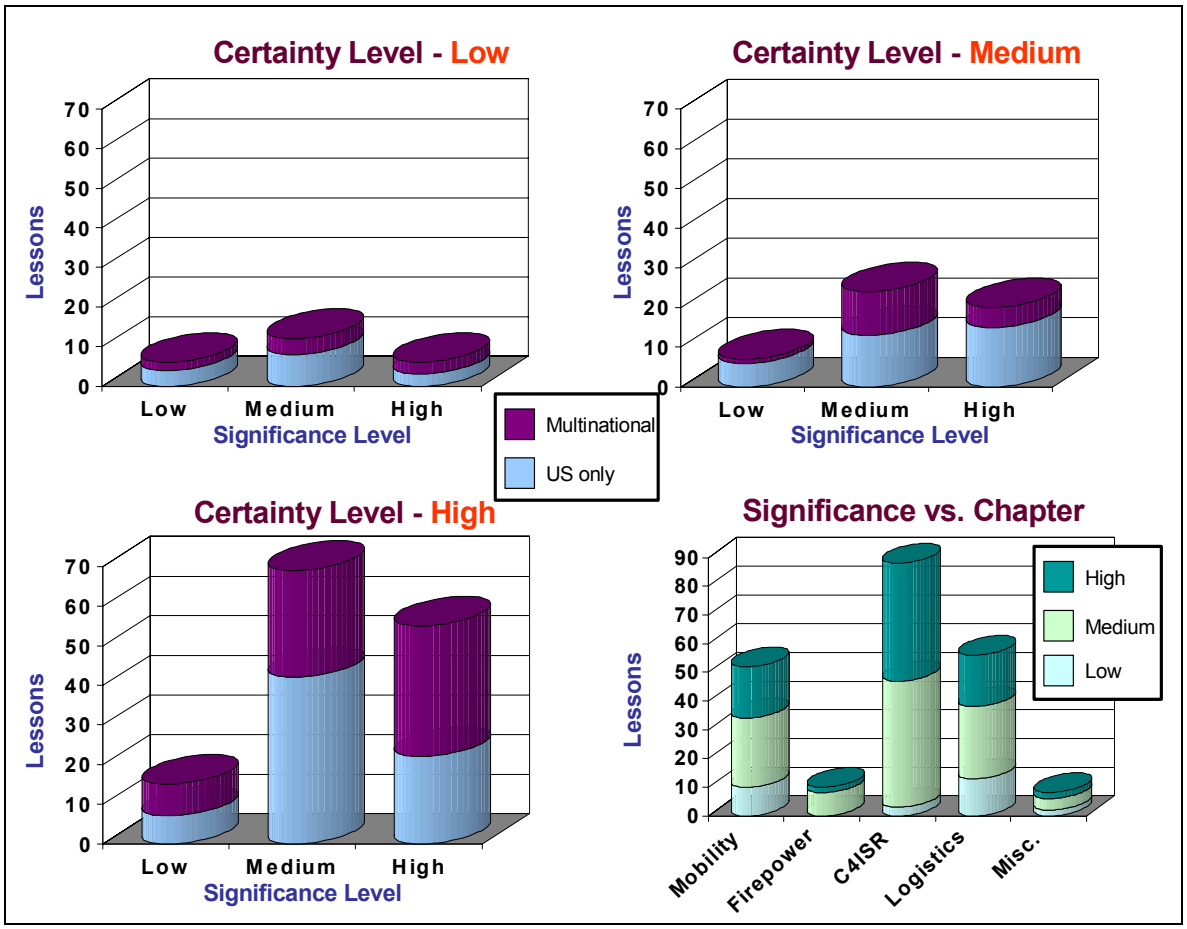

Figure 6. Lesson Significance and Certainty Level Statistics.

Chapter 1 - Mobility, Countermobility & Survivability

- Truck-trailer connection non-standardized - Noted limitation between the coalition force heavy tractors and trailers
- Need standard NATO tow bar – Limitation discussing capability of coalition forces to tow another nation's vehicles
- Recovery vehicle limited hardware – Capability to recover vehicles of a coalition partner often depended on having a large assortment hardware available to attach to the vehicle, thus the need for standardization or a large assortment of attachment devices is necessary
- Heavy Expanded Mobility Tactical Truck (HEMTT) grill hinders multi-national towing – Examines the difficulties associated with towing this tractor by coalition forces

Chapter 2 - Fires and Counterfire

- Ammunition: nations don't trust quality of other nation's ammunition – While the nations have munitions that are reported to be interchangeable, there is a general distrust concerning the reliability of another nation's ammo

Chapter 3 – C4ISR

- STANAG 5040 analog interface poor quality (e.g., Mobile Subscriber Equipment (MSE) to Ptarmigan) – Good news story of U.S.-U.K. working to gain interoperability between communication devices while detailing the need for further improvement
- NATO lacks a frequency management system – Discusses need for NATO asset to manage radio frequencies in large operations
- U.S. Secure Telephone Units (STU) and NATO STUs incompatible – Notes incompatibility of U.S. and NATO secure telephones
- Email architectures incompatible – Due to the lack of standardization among NATO nations there were numerous email systems being used early in the operation that were not compatible
- Limited secure communication between U.S. and NATO or non-NATO nations using frequency-hopping Combat Net Radios (CNR) – Likely one of the more significant findings, use of secure radios between the coalition forces ranged from limited to non-existent
- Friendly radar was painted as potential anti-radiation missile target (i.e., potential fratricide) – Surveillance problem identified that ties back to survivability
- Inadequate airspace management equipment – Due to the numerous air assets needing to be controlled, the resources necessary to perform these duties was insufficient
- Lack of Albanian linguists – Albanian linguist to fill intelligence roles and to simply converse with the local population were limited

Chapter 4 - Deployment & Sustainability

- Coalition force flat racks are incompatible – Interoperability between coalition force platforms to use each others flat racks was not always possible

- U.S. fuel hose couplings did not fit NATO rail tanker nozzles – Discussion concerning lack of hardware to match the many possible combinations of fuel hose couplings
- Tactical fuel handling equipment incompatible – As with the lesson on incompatibility between hose couplings above, this lesson describes difficulties with the fuel handling equipment in general
- Digital camera facilitates cross-nation maintenance – Good news story describing how a "picture is worth a thousand words" where the use of a digital camera by one country to email a picture of a vehicle problem allowed the other nation's maintenance crew to be fully prepared when they arrived on location
- Materiel Handling Equipment (MHE) interoperability limitations (e.g., lifting of Multiple Launch Rocket System (MLRS) pods) – Notes MHE capabilities, or difficulties thereof, to move coalition force goods
- U.S. industrial gas fitting kit lacks metric fitting – Focuses on problems associated with gas line connections between coalition countries

Chapter 5 – Miscellaneous

- Large Aviation Maintenance Shelters (LAMS) and aluminum matting would have provided better all weather helicopter capability - NATO lacked the resources to protect aviation assets from the elements

5. RECOMMENDATIONS

Recommendations are partitioned into two categories: one suggesting how further utility may be gained from the lessons and the second addressing how the collection of lessons may be improved.

5.1 Benefiting from the Study. First and foremost, it is AMSAA's recommendation that the lessons identified be reviewed by DA to determine if action is required. NATO will review for consideration those lessons developed at the Oct 2001 Synthesis Workshop.

AMSAA is not recommending definitive actions on any particular lesson. As previously noted, this effort was to collect, in a short period of time, as many land materiel interoperability lessons related to the Balkans as possible. The lessons would then be made available to NATO and DA, thus allowing them the opportunity to review, research, and determine further action. Research, during the study timeframe, to determine a reasonable recommendation for each generated lesson was well outside the study scope.

The lessons generated through this study are provided to DA and NATO to support future operations and interoperability exercises. The following bullets list additional ideas as to how this information may be productively used. Review of the following would be beneficial:

- NATO Standardization Agreements (STANAG) to determine if lessons generated through this study are accounted for within these agreements. The result could be a determination as to whether the STANAGs are lacking or if they are not being properly adhered to by the NATO partners.
- Major system Army Operational Requirement Documents (ORD) to establish if requirements adhere to current NATO interoperability standards.
- Functional Area Modernization Plans to verify that NATO interoperability standards are being considered as part of Army modernization.
- Army Transformation plans to ascertain that the interim and objective systems will have a focus on NATO interoperability.

5.2 Lessons on Lessons. During AMSAA's research phase, many roadblocks had to be overcome to gain the information. This section discusses AMSAA insights into conducting this type of study for any future endeavors.

- There is no single U.S. Army source for materiel lessons learned. This simple fact added considerable time and effort to the research. There are several organizations which maintain excellent data bases and libraries on lessons learned (e.g., CALL, JCLL, ULLOS); however, these efforts tend to concentrate on operational and doctrinal lessons. Materiel lessons can be found within these data bases, as was done, but the search can be tedious. A single Army organization focusing on materiel-related items would have reduced the research required to conduct this study. A lessons learned effort focusing on materiel issues would likely be useful to program managers and the acquisition workforce in general as they monitor issues related to various systems.

- A study In-Process Review (IPR) is critical for coordination in studies involving multiple nations. This study did not conduct an IPR. An IPR was requested by AMSAA through the DUSA-IA, but it was unfortunately denied by the NAAG. The study successfully produced lessons learned, but coverage, detail, and focus of lessons varied greatly among participating countries. This shortcoming could have been corrected with an IPR. AMSAA is of the opinion that while the study produced useful results, this lack of an IPR negatively impacted overall results since the level of effort and how each country approached the study significantly varied.

APPENDIX A – U.S. GENETRATED MULTINATIONAL LESSONS

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APPENDIX A – U.S. GENERATED MULTINATIONAL LESSONS

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-1		Truck/trailer connections (kingpin height and diameter) not standardized across NATO.
On larger 18 wheeled trucks and trailers there are two components to attach / connect the truck to the trailer. The Truck has a “5th Wheel” which connects to the trailer “Kingpin”. Two interoperability problems: (1) The diameter of the “Kingpin” is sometimes too large/small for the “5th Wheel”(2) The height of the “5th wheel” and “Kingpin” are not the same or in correct alignment. (Most common problem)Impact #1, trailer and trucks cannot always be attached. Impact #2, Sometimes the drivers jury-rig the attachments/connection to resolve #2 type problem, but this often causes additional tension, strain, and stress to the Kingpin and causes the kingpin to prematurely break.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-11		HEMTT (Heavy Expanded Mobility Tactical Truck) grill hinders multinational recovery/towing.
During exercise Heavy Lift / Clever Fix 1996, Some nation’s recovery vehicles were able to safely connect to HEMTT casualty vehicles, but the protruding front part of the cab prevented the casualty vehicle wheels from being lifted from the ground until either the grill or both front wheels were removed from the HEMTT first. The grill is fastened to the HEMTT with about 24-bolts and nuts. It took two people 45 minutes to remove the HEMTT grill.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-12		Possible need for HEMTT (Heavy Expanded Mobility Tactical Truck) lifting shackle pin safety wire.
During exercise Heavy Lift / Clever Fix 1996, a cotter pin is used on HEMTTs to hold the lifting shackle pins in place for safety to prevent the pins from falling out of the lifting shackle. A cotter pin is normally a one-time use item and it is very difficult to re use without pliers. Other nations use a hairpin or safety pin-type wire which is secured to the head of the lifting shackle with a light weight chain to prevent pin loss.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-15		US vehicles do not have self-activating air couplings (several nation's vehicles do).
During exercise Heavy Lift / Clever Fix 1996, several nations’ recovery vehicles were equipped with air couplings that had an integral dust cover and self-activating air supply valve. The US air couplings do not come with a dust cover – it has to be ordered separately. Nor, do the US couplings automatically open the air supply valve when both coupling halves are securely joined to each other, or turn off the air when the couplings are separated. Instead, the US system relies on the vehicle operator to activate and deactivate the air supply valve.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-155		Heavy combat vehicles damage the environment, create unnecessary maintenance and support requirements, and are not appropriate for the peace-keeping mission.
KFOR partners brought heavy combat vehicles to Kosovo. Vehicles such as main battle tanks and armored infantry fighting vehicles have little utility in the low-level security missions that have become KFOR’s main mission. Heavy tracked vehicles chewed up roads, damaged walls and buildings, and required extensive logistics manpower, but did not contribute to getting "soldiers on the street" to support UNMIK police patrols. “They don’t win us any friends when we damage the environment with (such) vehicles." - UK Task Force Cambrai officer.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-157		The crossing of Sava River near Zupanja was an engineering challenge and demonstrated the need for NATO and US to have improved large span bridging assets.

The greatest single engineer challenge in Bosnia was the crossing of the Sava River near Zupanja, Croatia. The mission was the largest operationally required river crossing since World War II. It was also the first real contingency use of the ribbon bridge. The crossing was conducted under extreme conditions. As engineer equipment was poised to cross, a thaw caused the Sava's width to swell from 300 to 600 meters. The flood plain where most of the equipment was marshaled became flooded. Despite these handicaps, engineers used Chinook helicopters to deploy ribbon bridge sections into the river while other engineers rebuilt the approaches. When the water receded, engineers built a causeway across the flood plain. Quote Tim Ripley, US Army Rebuilds Bridges, "…the US Army's larger support and logistic bridges proved to be out of date and difficult to deploy in the horrendous conditions of a Bosnian winter. The problems encountered trying to bridge the Sava River to allow US Army tank columns to move into Bosnia at the start of the NATO mission, was a salutary lesson in the costs of neglecting battlefield mobility assets."

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-159		Maneuverability of assets was severely restricted due to the lack of Class 60 or comparable bridging. The lack of adequate bridging capabilities impacted force survivability.

Maneuverability of assets was severely restricted due to the lack of Class 60 or comparable bridging. The lack of adequate bridging capabilities impacted force survivability.
Class 60 floating rafts and bridges consist of a deck constructed of flush surfaced steel-grid panels, supported by 24-ton pneumatic floats spaced 15 feet apart (center to center). Because of the weight of the individual components used to construct Class 60 bridges and rafts, these floating structures must be built using a 20-ton crane or a comparable lifting device. Class 60equipment can provide the crossing force commander with rafts supporting MLC 70 traffic in currents up to 8 FPS and bridges capable of supporting MLC 65 traffic in currents up to 5 FPS.
[Class 60 equipment is no longer authorized in US active, reserve, or National Guard float bridge companies. All remaining Class 60 equipment is currently maintained in depot stocks. One set can be used to construct one floating bridge capable of spanning a 135-foot gap or one four-, five-, or six-bay raft.
One set of Class 60 equipment is normally transported on a total of 13 bridge trucks. The US Army currently has little experience in the construction of Class 60 rafts. It is extremely difficult to provide an accurate estimate of the time required for construction. As a planning figure, at least 3 hours should be provided for the assembly of Class 60 rafts under ideal conditions. Source: http://www.adtdl.army.mil/cgi-bin/atdl.dll/tc/5-210/Ch6.htm]
The lack of class 60 or comparable bridging restricted the maneuverability of assets and impacted force survivability. Examples are:- Occupation of the best artillery positions could not be accomplished - Prevented artillery battalions from altering positions in order to maintain tactical security - Hindered the deployment of recovery assets, e.g. M-88

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-173		Apache helicopter is not instrument flight rules (IFR) rated while other countries are IFR rated.

GAO Issue #44. Task Force Hawk lesson learned reported by U.S. Army Europe. No details provided in GAO report. GAO recommends that implementation of this lesson learned is still in progress. PM Apache representative provided the following information: PM AES program called GATM (Global Air Traffic Management) is addressing various upgrades to system components / survivability equipment. PM Apache position is that the ORD does not require IFR. The FAA manages IFR systems; big dollar cost associated with equipment, and certification of aircraft and pilots for IFR. There is an ORD requirement for IMC - Instrumentation Meteorological Conditions. This is part of current system. Other countries do require IFR. HQDA briefing reports that there is no plan to fund additional instrument upgrades for the Apache to allow for self-deployment capability (e.g., IFR). See also LL 3.11 (inadvertent IMC recovery).

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-18		Difficult to tow a disabled M936 recovery vehicle from the rear - wrecker boom interference.

During exercise Heavy Lift / Clever Fix 1996, It was very difficult to tow the M936 recovery vehicle from the rear because the boom is in the wrong position when the engine is non-operational and the boom's hydraulic system is disabled.

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-2		Self-recovery tow bar assembly invaluable for breakdowns; need NATO standardized tow bar.
AOR specific self-recovery requirements included a tow bar assembly procured through the Army NSN 4910-01-365-9304. This item was invaluable for breakdowns without leaving equipment behind waiting for a wrecker; any vehicle could be towed with another in the convoy. The tow bar and assorted fittings used by NATO countries for towing are not standardized. A standard, NATO tow bar would improve interoperability between NATO vehicles.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-21		Lack of front pintle (for straight tow bar hook up) on disabled vehicles hinders recovery operations.
During exercise Heavy Lift / Clever Fix 1996, a straight tow bar could not be hooked up to the front of disabled vehicles because they did not have a tow pintle on or near the center of the front bumper.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-24		Instructions for preparing disabled vehicles for towing not readily available to recovery crews.
During exercise Heavy Lift / Clever Fix 1996, some vehicles required special preparation before they could be towed. These vehicles need to have clear towing preparation instructions readily available on the vehicle. This will assist personnel from all nations to prepare the vehicle for towing. Any special tools needed to prepare the casualty vehicle should be carried on the disabled vehicle. For example (Source 2), Some disabled vehicle operators' TMs (Technical Manuals) do not specify which propeller or half-shaft must be removed before a disabled vehicle can be towed. Not removing the correct propeller shaft on certain vehicles can damage vehicle components.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-29		Wood blocks and heavy rubber sheets were useful for protecting vehicles from damage during recovery operations.
During exercise heavy lift / clever fix '96, the UK recovery vehicle was equipped with several size blocks of wood. The wood is used as insulation between the recovery and casualty vehicle to minimize damage to body parts when the tow bar and hoisting mechanism are not 100 percent compatible with the casualty vehicle's lifting shackles. Additionally, one nation (US) improvised by using heavy rubber to insulate both vehicles from each other so as to minimize damage to metal body parts.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-3		Recovery vehicles need a large assortment of lifting shackles, pins, chains, and tow bars.
(1) During exercise Heavy Lift / Clever Fix 1996, some nation's recovery vehicles were equipped with a greater assortment of lifting shackle, pins, and chains than others. This improved the capability of the recovery vehicle to safely tow casualty vehicles using the preferred method: A tow bar with hoisting mechanism and safety chains.(2) The best recovery systems were the ones with the largest selection of spare lifting shackle and safety chains. The UK recovery vehicles were the most versatile vehicles because they had the largest assortment of shackles and chains.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-4		The "French Claw" mine removal tool was effective for removing surface laid mines on roads (helped to prevent damage to roads during demining operations).
An engineer company commander, who had attended the French Army Engineer Advanced course, used a French mine removal tool to develop a model for U.S. Engineers during Operation JOINT ENDEAVOR. The French Claw tool can be fabricated in the welding shop of a units motor pool. Aluminum is preferred because it is lighter, but steel is stronger, lasts longer and is more capable of pulling buried mines out of the ground. The French Claw is used to pull mines away from a road while maintaining a safe distance from the mine and under the protection of an armored vehicle. This is especially critical if the use of anti-handling devices is suspected. An AT (Anti-Tank) Mine Removal Procedure was developed using the French Claw. This procedure was initiated when surface-laid mines were discovered on a road and quick removal of the mine was paramount. The procedure was normally performed by combat engineers but could easily be executed by any group of soldiers with proper training. One benefit of the procedure is that it allows mines to be safely moved off of the road surface with out having to blow the mine in place, the usual technique. Blowing the mines in place can cause significant road damage. The procedure is conducted using the fabricated French Claw, a metal claw with attached lanyard that grabs the mine so it can be pulled away from the road surface. Anti-personnel mines are normally too small for the French Claw to grab.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-7		Some vehicle TMs (Technical Manuals) did not have vehicle specifications in metric and English units.
During exercise Heavy Lift / Clever Fix 1996, Some vehicle TMs did not have vehicle weight, height, etc. available in metric and English units. All TMs need to have a conversion chart / card to assist personnel in determining vehicle specifications. The appropriate numbers and languages chart / card need to be carried on the vehicle to assist in the recovery mission.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.1 Mobility	US	1.1-8		Front lifting shackles of 5-ton trucks can not be used for lift-towing.
During exercise Heavy Lift / Clever Fix 1996, the front lifting shackle brackets of 5-ton trucks with and without a winch can be used for ground-towing the vehicle, but not for lift-towing.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.3 Survivability	US	1.3-198		Lesson Removed.

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.3 Survivability	US	1.3-263		The FireFinder Radar presented a challenge to NATO aerial sensor assets; they were identified as potential enemy targets on several occasions.
The FireFinder artillery radars (Q-36 and Q-37) were identified as potential enemy targets on several occasions by Navy aircraft. US Navy and German Tornado HARM shooters can acquire radar emitters within range as potential targets. This is a repeat of a lesson learned the hard way in the Gulf War and is critical to the ongoing challenge of preventing fratricide.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.3 Survivability	US	1.3-279		Lesson removed.

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.3 Survivability	US	1.3-298		Lesson removed.

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.3 Survivability	US	1.3-306		Night vision capability is needed in base camp security.
Camp Able Sentry, Macedonia, took measures to improve perimeter security by equipping tower guards with thermal sights. The USAREUR Science Advisor arranged for the transfer of 5 AN/PAS-13 Thermal Weapon Sights (TWS) from Camp Bondsteel, Kosovo. CECOM NVESD personnel fabricated mounting hardware and 220 volt power supplies and purchased monitors for each guard tower within days of being notified. Installation was successfully completed.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.3 Survivability	US	1.3-316		Normal scale (1:25,000 and 1:50:000) military maps are inadequate for a MOUT (Military Operations in Urban Terrain) environment.
In July 99, the Assault and Obstacle Platoon, Bravo Company, 9th Engineer Battalion (Combat) supported peacekeeping operations in the city of Gnjilane, Kosovo (capital of and largest city in Eastern Kosovo). Operations included dismounted patrols, checkpoint operations and building searches. Normal scale (1:25,000 and 1:50:000) military maps do not suffice in a MOUT environment. Military maps of Gnjilane only showed the main routes, so the platoon used "tourist maps" of the city. These large-scale maps, which were obtained through the help of civil affairs, showed every street in the sector. Since patrols were unable to determine grid locations using the city maps, they took a PLGR (Precision Lightweight GPS Receiver) along in case a grid location was required.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.3 Survivability	US	1.3-33		Lesson removed.

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.3 Survivability	US	1.3-34		Lesson removed.

Sub-chapter	Country reporting	Lesson number	Classification	Title
1.3 Survivability	US	1.3-35		Lesson removed.

Sub-chapter	Country reporting	Lesson number	Classification	Title
2.2 Weapon Systems	US	2.2-300		Camouflage, concealment and deception (CCD) were effectively used to conceal real targets. The result was that many of the real targets were not engaged or destroyed.
Intelligence sources that surveyed the battlefield after the conflict reported that potential targets were painted to make them look like they were damaged to confuse BDA (Battle Damage Assessment) and target selection. Other incidents were reported of mobile targets such as tanks seeking cover in forests and woodlands to minimize exposure to precision-guided weapons.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
2.2 Weapon Systems	US	2.2-42		UNPROFOR handover of artillery survey points to IFOR was not satisfactory.
During transition, most of the established artillery survey points could not be found, and the Air Force/Special Forces units did not have resources to establish initial survey. Units were equipped with the PLGR (Precision Lightweight GPS Receiver), but they did not know its accuracy. Additional text accompanying the "Does this affect interoperability" section: Interoperability is impacted by mission readiness of the unit employing the degraded or non-performing weapon along with the ability of a weapon system to kill a target when threatened.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
2.2 Weapon Systems	US	2.2-43		Continuously running the PADS (Position Azimuth Determining System) to extend survey for Task Force Hawk MLRS firing positions damaged the components.
Accurate survey is essential for fire support units. The battalion survey teams used the survey control point established by a topographic team to extend survey to the firing points. This required a zero-velocity correction for the PADS every 10 minutes. The PADS had to stop during convoy operations every 10 minutes to update its system (more survey control points in the area of operation would have eliminated extending the survey control so far). At one time during the operation, the battalion had two out of three PADS non-mission capable.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
2.2 Weapon Systems	US	2.2-45		Restricted terrain prevented use of the best artillery firing positions and limited coverage to less than 6400 mils.
Only major routes and limited off-route areas are known to be free of mines. As a result, artillery fire units usually deployed on either the cleared routes or on paved surfaces near urban areas, where buildings blocked the guns. Field artillery missions include suppression of enemy air defense. Restrictions on the selection of the best firing positions impact force (and firing battery) survivability and effectiveness.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
2.5 Ammunition	US	2.5-39		Most countries, including the U.S., do not trust the condition of other nation's ammunition.
NATO ammunition booklets list ammunition that has been tested and found to satisfy interchangeability criteria, and there is a NATO standard color code to label ammunition by type. However, in practice, except for life-threatening situations, most soldiers do not use ammunition that is produced by another country. However, AOP-6(N) needs improvement due to inconsistent observations and notes.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
2.5 Ammunition	US	2.5-40		Lesson removed.

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-179		Fielding of Balkans Digitization Initiative (BDI) was successful, but it was not interoperable with NATO or PfP nations.
The BDI provided US units and commanders with near real-time display of location of BDI equipped units. This allowed commanders with a GCCS-A (Global Command and Control System - Army) or BDI capability to track the position of units and to transmit or receive limited text messages (e-mail). However, this information was not available to other NATO or PfP nations. This was strictly a US Army initiative.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-181		NATO CRONOS Network was a valuable asset in Operation Allied Force.
The Crisis Response Operation NATO Open Systems (CRONOS) was the most valuable automation link during this operation for passing and sharing intelligence and operational information, and pulling usable intelligence from the classified internet within the CAOC (Combined Arms Operation Center). The CRONOS system is the one common classified automated means to share NATO Secret, NATO Confidential, and Secret Releasable NATO information within the AFSOUTH AOR. It has user-friendly e-mail utilities. All entities within the CAOC use this system for virtually all information sharing. The CRONOS uses the same "pipe" as the Linked Operations-intelligence Centers Europe (LOCE). [The LOCE system is the principal means for the automated transfer of operations and intelligence information between the U.S. and NATO Allied Command Europe (ACE). Additionally, the LOCE system facilitates multinational operations and allied participation in the intelligence cycle and supports battle damage assessment and coalition target nomination through an intra-theater and international exchange of secondary imagery among its users. The functions of the BCE (Battlefield Coordination Element) Intelligence section within any NATO operation require the common link that CRONOS provides. LOCE is a bonus and would be necessary in the absence of JDISS (Joint Deployable Intelligence System Support).				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-182		Lesson removed.

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-187		Medical unit lacked sufficient communication systems during exercise.
On 5 May 2001, a MASCAL (Mass Casualty) Exercise was conducted at Camp Dobol in conjunction with Dynamic Response. The MASCAL exercise was designed to facilitate multinational coordination and execution in a MASCAL situation. Situation: Camp Dobol is located approximately 20 kilometers (km) from Eagle Base and 21 km from Camp Comanche. Fifty (50) soldiers from the Nordic-Polish Battle Group participated in the exercise as casualties. Injuries ranged from minor cuts and bruises to amputations, with 15 casualties requiring immediate evacuation to save life, limb, or eyesight. All other casualties were delayed or minimal. The exercise commenced with two explosions occurring at two different locations on Camp Dobol at 1037 hours on 5 May 2001. All of the seriously wounded casualties were located at the front gate of Camp Dobol, the other casualties were located within the Life Support Area (LSA). There were approximately 100 personnel involved at the exercise on Camp Dobol. The only available and working communications system available on the scene was the Single Channel Ground and Airborne Radio System (SINCGARS) radio in the Mayor's Cell. This severely limited the ability to communicate with Eagle Base and Division Operations. In order for the G-3 to communicate with the scene, TF 2-121 had to relay the message via the retransmission (RETRANS) station. The MEDEVAC frequency was used by everyone for communication on the scene. This caused excessive radio traffic on a frequency that is solely dedicated to air ambulances.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-194		The STU-III's used exclusively by US forces were not operationally configured to interoperate with the NATO approved STU-IIB's.
The non-US NATO countries were not able to communicate with the US forces that used the newer STU-III phones. This problem was never completely resolved.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-272		The use of the Joint World-Wide Intelligence Communication System (JWICS) helped facilitate a joint, near real-time, intelligence collection and dissemination environment for multi-service and multi-national surveillance assets.
JWICS is used for tactical communications and is accredited for SCI (Sensitive Compartmented Information) level information. The purpose of this system is to facilitate collection management, threat warning and situation awareness for the joint collection community. This system is used to post and disseminate intelligence information throughout the theatre of operation through multi-service and multi-national intelligence collection units. A feature of JWICS is a "chat room" type of operational use that allows multiple users to communicate real-time with authenticated access managed by the Joint Task Force Collection Manager. The use of JWICS in Balkans operations helped facilitate a joint, near real-time, intelligence collection and dissemination environment that came about through happen-stance with no training/doctrine containing this requirement. This "chat room" mode allowed mission managers from Guardrail Common Sensor (GRCS), Rivet Joint, JSTARS and NIMROD to communicate near real-time. This allowed for real-time queuing of surveillance assets that allowed joint dissemination, confirmation and other assistance with collection (e.g. using GRCS to more accurately locate emitters initially detected by Rivet Joint).				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-313		Ensure communication systems have extended operating ranges for beyond line of sight communications.
Operation Joint Guard. Task Force Eagle. The commander must ensure that a strong and ongoing communications link is established with Army airborne command and control (A2C2) elements at all levels. Required communications for A2C2 in Multi-National Operations: Secure Telephone Unit (STU- III), Crisis Response Operation NATO Open Systems (CRONOS) in NATO operations, Mobile Subscriber Equipment (MSE), Satellite Communications (SATCOM), Very Small Aperture Terminal (VSAT), Local Communications Network (Sprint, ATT, etc.), Email and internet access for acquiring and publishing NOTAMS (Notice to Airmen and Sailors), Regulations, and Publications.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-41		Incompatible aviation navigation and communications systems.
The navigation and communications systems in the former WARSAW Pact nations' aircraft are not compatible with U.S./NATO systems.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-48		There was no standard e-mail client/server architecture used throughout the IFOR. This required many workarounds and additional equipment to provide e-mail access to the multinational force. (IFOR, ~1996-1996)
The proliferation of different computers and operating systems and the recognized utility of e-mail as a means of communicating, resulted in problems in establishing an interoperable e-mail network throughout the IFOR. Many users arrived with different operating systems, different e-mail clients and different means to access the network. Initially, Microsoft Mail servers were established in several places (e.g., Zagreb at the UN compound). However, only Windows platforms could access the server. Other computers operating on UNIX or Apple computers could not access the e-mail server. Those units had to purchase PC with Windows operating system just for e-mail access. An open e-mail standard, such as POP-3, can be accessed from many different platforms including Windows, UNIX, and Apple computers. There are widely available POP-3 client programs (even freeware) available which will allow access to POP-3 e-mail servers from just about any type of computer/operating system.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-49		ThinNet (10Base2) LAN topologies unreliable compared to 10BaseT or Unshielded Twisted Pair (UTP) networks
At command centers which required LAN (Local Area Network)/WAN (Wide Area Network) access, coaxial ThinNet LAN cables (10Base2) proved to be less reliable than 10BaseT or Unshielded Twisted Pair (UTP) cables. Attenuation caused by bending coax cables around corners and poles were difficult to isolate because cable testers only test for short or open circuit in cables. Also adding or removing a workstation from the LAN or removing the termination resistor interrupts service to all workstations on that segment.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-51		UHF (Ultra High Frequency) SATCOM critical to IFOR mission and establishment of tactical networks. Lack of SATCOM terminals during initial deployment hindered efforts.
Reliable, secure, long distance communications was necessary to establish the base camps and conduct the IFOR mission prior to establishment of the strategic and tactical switching networks. SATCOM was necessary during the initial deployment for reachback communications and to establish the tactical switched networks between the base camps. However there were limited quantities available. UHF SATCOM was also needed to overcome terrain and distance restrictions without deploying VHF (Very High Frequency) FM retransmission stations. Retransmission stations could not always provide the required coverage, took considerable time/manpower to plan and deploy, and required extra personnel for physical security. UHF SATCOM provided secure, reliable communications unaffected by terrain and distance and avoided the need for additional personnel to plan, deploy and secure retransmission sites. Motorola LST-5Es were eventually procured and worked very well for the IFOR.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-52		Interoperability of US TRI-TAC/MSE and British PTARMIGAN Tactical Switched Systems using STANAG 5040 analog interface tended to be troublesome and poor quality at times. A digital interface using the British prototype IDIP was easier to establish/maintain and provided better circuit quality than the analog interface. (~1995-1996)
The analog interface between the US TRI-TAC / MSE (Multiple Subscriber Equipment) systems and the British PTARMIGAN system using the STANAG 5040 interface at times proved to be troublesome and provided poor voice quality. The multiple A/D and D/A conversions required added noise and distortion to the signal. The British developed a digital interface (Interim Digital Interface Ptarmigan – IDIP) that improved voice quality and proved to require less operator attention. Although this interface did not conform to the digital NATO interface specification (STANAG 4206 – 4212) and had some shortcomings in it's capabilities, it proved that a digital interface was more reliable and of higher quality than the analog interface. Currently, only the Dutch Zodiac, the Norwegian TADCOM, the LANDCENT RMA, and the US Mobile Subscriber Equipment (MSE) and AN/TTC-39D switches have the STANAG 4206 digital interface implemented.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-54		The NATO analog switching interface (STANAG 5040) is slow to make connections.
The NATO analog interface (STANAG 5040) is used to interface national tactical switches. This analog interface is slow to make calls between different national systems because it uses a slow pulse dialing technique versus a digital or Dual Tone Multi-Frequency (DMTF) technique. Operators had to wait an excessive amount of time for the interface to dial the number.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-55		NATO LAN/WAN extension to the field was a resounding success. Reduced and almost eliminated NATO message network (TARE) during OJE (Operation Joint Endeavor).
With the extension of the NIPRNET (Unclassified but Sensitive Internet Protocol Router Network) and SIPRNET (Secret Internet Protocol Router Network) to the field, almost all AUTODIN / message traffic was sent via e-mail. The NATO TARE network was rarely used because of its slow response. As a result, all the planned TARE interfaces were not established because the unclassified and classified e-mail networks were used to support the message traffic.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-56		Video Teleconference (VTC) was a widely used command and control tool during OJE (Operational Joint Endeavor). Need to standardize on format and bandwidth.
VTC quickly became the tool of choice for C2 at the NSE level down through brigade level. However, the tactical communications systems (TACSAT) were inadequate to satisfy the demand. This was quickly realized and efforts were immediately focused on commercializing the VTC network using E-1 lines and commercial SATCOM. There were also problems with compatibility of various VTC systems, using different bandwidths and formats.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-58		STANAG 5040 analog interface between the US TRI-TAC / MSE (Mobile Subscriber Network) system and British/French circuit switching systems using CV-3478 NATO Interface Unit (NIU) was troublesome to establish and required periodic adjustment and calibration (~1995-1996).
The CV-3478 NIU analog interface between the US TRI-TAC / MSE systems and the British PTARMIGAN / French RITA circuit switch systems was troublesome to establish and required periodic adjustment and calibration. The CV-4002 NATO Analog Interface (NAI) was easier to establish because of its digital interface to the TRI-TAC/MSE switches and it had automatic line level adjustment/calibration capability. The CV-3478 NIU has an analog interface to the US switches and requires manual periodic adjustment and calibration, which the operators assessed as excessive.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-59		Lack of NATO Frequency Management Systems
NATO Message Switch Centers (MSC) were not capable of creating frequency allotments, and assignments for reaction force operations without total dependence on US and UK national resources. This is most difficult for the Land Component where the number of emitters can run into the thousands and composition of forces is inexact. Frequency requirements may not be known in time to react to an activation order. 5th Signal Command, HQ ARRC and 1st Signal Bde (UK) jointly created the frequency database, allotments and assignments for the theater. NATO did not possess systems or personnel to carry out this vital function. The US Network Planning Tool (NPT) and the Revised Battlefield Electronic CEOI System (RBECS) were used very successfully. Although this joint effort was successful, OJE is essentially a static operation. The task would be much more difficult in a mobile operation.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-60		Insufficient number of Data Transfer Devices (DTD) to electronically distribute COMSEC/SOI material.
During OJE (Operation Joint Endeavor), a network to perform over-the-air-distribution (OTAD) of COMSEC (Communications Security) materiel using the STU-IIB was planned. This network would have allowed OTAD from the theater distribution agency down to Brigade level. However, this network was never put into operation because there were very few DTD or CYZ-10 devices to receive the information. Instead, couriers were used to distribute COMSEC information. Had there been an emergency, NATO would not have been able to distribute COMSEC info in a timely manner.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-61		European and Northern America Switch and Signal Protocols are not interoperable.
Electronic communication devices such as FAX, computers, videoconferences require protocol procedures to begin communications. Most European countries are using ISDN protocol procedures. The USA uses two protocols: East Coast and West Coast origins. The two USA protocols communicate with each other. The European – ISDN switches and signal protocols do not interface or communicate with USA protocols. Most USA and European computers, faxes, and videoconference electronics devices cannot communicate.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-64		Secure communications between US and NATO or non-NATO nations using frequency-hopping Combat Net Radios (CNR) is not possible. UAE and US AH-64 APACHE helicopters cannot communicate using frequency hopping VHF CNRs.

The United Arab Emirates (UAE) AH-64s and the USA AH-64s flew missions together in Bosnia. The UAE AH-64's are not equipped with SINCGARS. The VHF combat net radios (CNRs) on the UAE AH-64s are only capable of operating in single frequency, plain text (unencrypted) mode. Hence, the UAE AH-64 pilots could not communicate with USA AH-64 pilots in the more secure frequency hopping, cipher text (encrypted) mode of SINCGARS (Single-Channel Ground and Airborne Radio System). Neither could the UAE AH-64 pilots communicate with ground crews/forces in the frequency hopping, cipher text mode. Coalition missions involving non-NATO AH-64s required that communications be conducted over single frequency, unencrypted channels. US forces thus took on additional risk by operating in this unsecured mode of communication. Only NATO nations, Australia, and New Zealand are able to purchase SINCGARS radios with the US TRANSEC and COMSEC module. All other nations receive an export version that has a different TRANSEC and COMSEC module. The export version is not interoperable with the US version in the frequency hopping, cipher text mode of SINCGARS. In addition, the export COMSEC and TRANSEC modules are different for each nation. Thus, the export radio for the UAE is not compatible with the export radio for Saudi Arabia. The export version of SINCGARS only exists in the ground configuration. The high non-recurring cost to reengineer the SINCGARS airborne radio for export was not justifiable by foreign nations because of the small numbers that would be ordered. Thus, an export version of the airborne SINCGARS radio does not exist. Even if one were produced, it would not be compatible with the US version because of the different TRANSEC and COMEC modules.

Importantly, the interoperability of VHF CNR is a larger problem than depicted here among attack helicopters between the USA and UAE. NATO/Coalition forces (ground and air) CNRs are not interoperable with USA CNRs in either the frequency hopping mode or cipher text mode. For NATO nations, communications with USA VHF CNR can only occur in the single frequency, plain text mode if the NATO force does not have a SINCGARS (NATO STANAG). The only nations with plans to field large quantities of SINCGARS radios are Italy and New Zealand. Many other NATO countries have SINCGARS, but in relatively small quantities for special units (e.g., Dutch PATRIOT units, Greek MLRS units). Thus, CNR communications between multinational units must be accomplished either by one nation providing a liaison with secure communications equipment to the other nations involved in the mission or communicate in single channel, plain text (un-encrypted) mode.

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-66		Ultra High Frequency (UHF) satellite communications on the move capability was successful in the Balkans.

PM MILSATCOM provided 3 fully mobile UHF SATCOM On The Move, (SOTM) systems for HQ TF-Eagle HMMWVs (High Mobility Multipurpose Wheeled Vehicle). The SOTM systems permit communications with DOD UHF satellites in any direction, to about 15 degrees above the visible horizon, without requiring that the vehicle halt to erect and orient a traditional UHF SATCOM antenna. The systems provided by PM MILSATCOM are an integration of GOTs/COTs equipment.

In addition to mobile SATCOM voice capability, vehicles equipped with the SOTM system, and vehicles equipped with both SINCGARS (Single Channel Ground and Airborne Radio System) and SOTM functioned as rolling SATCOM re-transmission stations, linking all SINCGARS radios in a geographic area via SATCOM.

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-67		SHF TACSAT network required additional 20 ft. dish antennas to achieve required bandwidth. The gain of the standard 8 ft. antennas was insufficient to provide the necessary connectivity/bandwidth.

On initial deployment, SHF TACSAT (TSC-85) was necessary to implement reachback circuits and the theater network. The load on these TACSAT channels necessitated that they operate at their highest data rate. This meant operating using QPSK modulation that requires a higher signal level for satisfactory operation. The 8 ft. antennas did not provide satisfactory performance at the high data rates because of its lower gain. This meant either operating at a lower data rate using BPSK modulation or procuring additional 20 ft. antennas that provided sufficient gain for satisfactory channel performance at the high data rate. Six additional 20 ft antennas were delivered to 7th Signal Bde for operations at major hubs. As the operations proceeded, commercial TACSAT and landline replaced much of the SHF TACSAT in theater. TACSAT supported all NATO tactical circuit/message switches.

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-68		TACSAT communications were essential to the establishment of the tactical networks in theater.

Because of the distances involved, poor ground security environment, and mountainous terrain, satellite communications were vital to success. All of the 7th and 22nd Signal Brigade's SATCOM was placed in operation. These USAREUR terminals were augmented by numerous Air Force, NATO and, British terminals. The CJCCC designed and implemented a large and complex, multinational, SATCOM network which met the NATO theater commanders' operational priorities. This was largely because the NATO Communication Support Activity (NACOSA) had space segment available to offer nations if they delivered the military SATCOM terminals. Due to the popular use of Video Teleconferencing (VTC), SATCOM capacity was stressed during OJE (Operation Joint Endeavor). Additional TACSAT terminals could have been used to reduce congestion and increase quality of service. Had an emergency or crisis situation emerged, the congestion on the SATCOM networks would have been even worse. The lack of communications infrastructure required that TACSAT be used until the infrastructure could be rebuilt and commercial SATCOM could be employed.

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-69		Transitioning US TRI-TAC/MSE (Multiple Subscriber Equipment) switching systems from TACSAT to commercial IDNX required digital data group modems (MD-1026) from Line-of-Sight (LOS) radio vans and fabrication of special cables.

During the transition of the long-haul communications links from TACSAT to the commercial IDNX (Integrated Digital Network Exchange) network, digital group modems were required to interface the switch trunk groups with the IDNX. These digital group modems (MD-1026) had to be stripped from the TRI-TAC LOS radio vans (TRC-173/174/175). Without the MD-1026 modems, the LOS radio vans could not be used elsewhere in the network for trunking had the need arisen. In addition, the IDNX did not have an unbalanced condition diphase interface. This necessitated the fabrication of cables by the signal group to convert the unbalanced conditioned diphase signals to non-return to zero (NRZ).

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-70		British EUROMUX switch would not interface with TRI-TAC TTC-39D switch during OJE (Operation Joint Endeavor).

In Oct '96, efforts were made to interface the British EUROMUX switch with TTC-39D switch. EUROMUX was planned to replace the PTARMIGAN in the British Division sector. However, testing of the interface failed. The EUROMUX was not capable of the STANAG 5040 6 wire ENM interface, 4 wire multi frequency dial tone, or 4 wire ENM. Partial success was achieved with a 2 wire analog interface, enabling EUROMUX to call into the TTC-39 with operator intercept, but the 39 could not call the EUROMUX. Due to the interface problems encountered, the EUROMUX was not installed at this time.
Additional text included as a footnote to the "Does this affect interoperability question?":
The EUROMUX switch was not installed. British stayed with PTARMIGAN switches

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.1 Communications	US	3.1-71		The free flow of information between coalition, NATO, and US forces was hampered due to the use of five mutually exclusive networks.

Due to the nature of the work being performed, the following networks were used by the various different forces in the AOR (Area of Responsibility): NIPRNET (Unclassified but Sensitive Internet Protocol Router Network), SIPRNET (Secret Internet Protocol Router Network), CRONOS (Crisis Response Operation NATO Open Systems), JWICS (Joint World Wide Intelligence Communication System), and the KFOR secret net. The SIPRNET is a US only secret network, the NIPRNET is an unclassified but sensitive network, CRONOS is a NATO version of the SIPRNET, JWICS is a Top Secret intelligence net, and KFOR secret net is a coalition secret network. For obvious reasons only the KFOR Secret net was open to all KFOR participants. Users requiring access to information on multiple networks required multiple machines/computers/platforms, one connected to each network. Consequently data transfer between the networks had to be scrubbed and manually moved using floppy media. In some cases, US forces with access to SIPRNET or CRONOS didn't have a KFOR net available to them. Therefore to get messages to them required sending the info via maize of headquarters and networks.
Ideally, a single platform capable of connecting to multiple networks simultaneously with a multi-level security, trusted hardware/software architecture would be desired.

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.2 Surveillance and Counter-surveillance	US	3.2-205		Sharing Intelligence with Allies and Non-NATO Partners
The amount of intelligence support USAREUR would, or could provide to non-NATO allies participating in OJG was problematic due to classification and automation difficulties. Rules for disclosure and release to coalition partners are not automatically applicable from one operation to the next. The procedure to share intelligence was cumbersome at best. The shortage of CRONOS (Crisis Response Operation NATO Open System) and LOCE (Linked Operational Intelligence Centers Europe) automated systems and their inability to handle large volumes of data did not contribute to timely sharing.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.2 Surveillance and Counter-surveillance	US	3.2-269		There was a lack of flight deck space for U.S. Army use at Crete which resulted in significant operation constraints for GRCS.
The GRCS Integrated Processing Facility (IPF) was located in Brindisi, Italy. Due to the limited airfield deck space at this airport, the GRCS RC-12 aircraft had to be kept in Naples, Italy. Brindisi was the required location for the IPF and the RC-12 refueling point. The additional flight hours and take-offs/landings significantly constrained operational availability for the GRCS unit. After three days of operations, the pilots were expended. Eventually this problem resolved itself during the Balkans operations since the U.S. Air Force eventually vacated that aircraft facility.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.2 Surveillance and Counter-surveillance	US	3.2-79		Release of Joint Stars intelligence products was a problem.
Potential consumers of JSTARS (Joint Surveillance Target Attack Radar System) products included both NATO and non-NATO members of IFOR. Upon arrival in Bosnia in late 1995, the Ground Station Modules (GSM) (systems and support personnel) had not been coordinated at the national levels nor their acceptance articulated to the supported units. An additional factor in dealing with our Allies was the impending NATO selection of a ground surveillance system. The French entrant in the competition is the Horizon, an MTI radar which lacks JSTARS synthetic aperture radar (SRA) capability. The Italians have a comparable heliborne platform called CRESO. The British Stand-Off Radar (ASTOR) is on the drawing board with a 2001 projected service date.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.2 Surveillance and Counter-surveillance	US	3.2-81		More effective early warning equipment is needed to alert (Task Force Falcon) to possible air attacks.
The only early warning capability in Task Force Falcon was via FM voice communications.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.2 Surveillance and Counter-surveillance	US	3.2-90		There is a need for a covert method of tracking certain vehicles.
NATO has relationships with many local individuals. Some of the individuals are suspected of terrorist activities, but individual activities and loyalties are not easy to determine. A vehicle tracker would help determine the activities of suspect individuals. The Vehicle Tracker is a radio transmitter the size of a cigarette pack or smaller with a magnet to attach it a vehicle. Once the Vehicle Tracker is on an individual's vehicle, the vehicle location can be monitored.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.3 C2 Systems	US	3.3-324		Power Scene, a commercial terrain information system, was successfully used by Task Force Eagle to assist in planning operations in Bosnia and Herzegovina (B-H).
The Power Scene system proved to be an excellent tool for terrain visualization. Power Scene gives commanders and planners the ability to picture routes from an aerial view to plan convoy routes, bypasses and pull-over areas. It also allows commanders to view line-of-sight and fields of fire, to pre-select communication and radar sites, and to view the infrastructure of cities and possible locations for base camps. Aviation units can use Power Scene to determine air corridors, view possible helicopter landing zones, and assist in search and rescue mission planning. Power Scene was used by the Air Force for mission planning while conducting NATO air strikes. The system uses Digital Terrain Elevation Data (DTED) Level one and merges it with Land sat Satellite Imagery. This produces a graphical 3-D view of an area in seconds, once all the topographic data are entered.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.3 C2 Systems	US	3.3-91		Task Force (TF) Hawk usually presented its targeting products graphically using the ADOCS (Automated Deep Operations Control System) rather than developing and distributing the doctrinal targeting products outlined in FM 6-20-10. ADOCS allowed members of the TF staff, who traditionally are left out of the targeting process (lawyers and civil affairs) to review targeting products and approve targets from a Rules of Engagement (ROE) and humanitarian standpoint.
TF HAWK developed and published a High Payoff Target List (HPTL), Attack Guidance Matrix (AGM) and Target Selection Standards (TSS) for its mission of conducting deep attacks. Their technique was to use ADOCS to distribute targeting products unique to TF Hawk. These products consisted of maps displaying enemy locations, color coded targets scheduled for attack, acquisition assets and the routes and times they were available to the TF. The TF used ADOCS very effectively. The TF Hawk decision not to use advanced field artillery tactical data system (AFATDS) was four-fold: 1) Current AFATDS software could not compute missile flight path data accurately for ATACMS fires. The FCE primarily coordinated and planned deep fires for the MLRS employing ATACMS. 2) Horizontal connectivity with ASAS and MCS wasn't needed because ASAS and MCS weren't used in the DOCC. 3) The FCE was comfortable using IFSAS. The section did not feel that AFATDS is as user friendly as IFSAS. 4) AFATDS is not fielded to subordinate Field Artillery units and operational facilities.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.3 C2 Systems	US	3.3-93		All Source Analysis System (ASAS) was modified to better graphically reflect the multi-national environment.
The ASAS receives information concerning the enemy, analyses the data, and creates/displays an INTEL picture. The ASAS was designed for a large-scale war in Europe between the USSR and NATO. The ASAS display only two colors: Blue-“good guys”, Red-“bad guys.” Equipment and troops associated with each nation are linked to Blue or Red. This generated two problems: 1) Russia and other nations (now allied) were affiliated as Red-“Bad”. Furthermore, Russia was given an ASAS. They are “Good Guys” on NATO's side in the Balkans, but they were displayed as Red-“bad guys”. Hence, ASAS equipment needed to re-affiliate all the past “enemies” equipment as Blue-“Good guys” before giving the ASAS to Russia and other NATO nations. 2) In the Balkans, some people were/are difficult to map as good or bad. 3) Some Bosnia equipment / troops were considered friendly and some hostile. Hence, more then 2 colors were required to track uncertain equipment/troops. The correct affiliation and additional colors have been added to the ASAS equipment.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.3 C2 Systems	US	3.3-95		Pitfalls of U.S. Only Classification of Enemy Intelligence in a NATO Operation
Task Force Hawk All Source Control Element (ACE) produced mission and intelligence reports that were not releasable to NATO. This degraded their ability to influence the targeting process at the Combined Air Operations Center (CAOC) for the first sixty-five days of Operation Allied Force. (CAOC operated by NATO rules.) Support aircraft from various nations could not receive information on operations that they were tasked to support.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.3 C2 Systems	US	3.3-96		Minefield record-keeping and information dissemination was mediocre.
Initially, a mine reporting and data collection section was established in Tuzla. Task Force Eagle relied on manual reporting efforts to tabulate and track mines. The 1AD Engineer Brigade's challenge included custodian of the battlefield, developer of mine data, and distributor of mine information. Combat engineers plotted over 6,000 minefield locations by hand. The accuracy of the plots is unknown. Black and white maps were produced from the resultant overlays. This step introduces errors. The United Kingdom’s "Taciprint" System was used to produce the maps. Taciprint is a truck-mounted printing press. It is a rugged system designed for field use. The E-OPS (Engineer Operations) System augmented the Taciprint with an electronic plotting capability. There are more modern systems available, but they are not field proven. The newer systems provide the ability for rapid changes and dissemination of collected data, but they do require a controlled and stable environment. E-OPS provides a digital planning tool in support of mobility, counter mobility, and survivability missions. The system is in development at the U.S.’ Waterways Experiment Station.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.4 Reconnaissance	US	3.4-302		Lesson removed.

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.4 Reconnaissance	US	3.4-83		Operators of infrared target acquisition systems need better training in combat vehicle recognition.
Soldiers could benefit from a multimedia thermal training software package called Recognition of Combat Vehicles (ROC-V. In the mid 1990's, Night Vision and Electronic Sensors Directorate and PM FLIR developed a multimedia thermal training software package called Recognition of Combat Vehicles (ROC-V). ROC-V was designed to train FLIR operators to recognize and identify ground combat vehicles.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.5 Information Operations	US	3.5-108		Foreign language conversion software and prerecored translations for the Balkans languages is needed.
Language conversion software (dictionary AND syntax) is available for the world's predominate languages, but not for the languages of Balkans natives. One such program is the Forward Area Language Converter (FALCON). Throughout the Balkans there are roadblocks and checkpoints where native drivers must stop for vehicle search or people on foot need to be searched. It is preferred to have a translator to help NATO Soldiers communicate with the natives during the inspection. However, there is a shortage of trustworthy translators. The U.S. Army located and obtained Albanian linguists through TRW. TRW located and obtained the majority of the linguists from an Albanian community in Cleveland, Ohio (each were offered approximately $40,000/year). The Rapid Audio Phase (RAP) equipment is an idea being considered to help reduce the requirement for human translators. RAP has a CD with recording capability. The CD also has pre-recorded phrases such as "Please get out of the Car", "Please open the trunk", etc. The recording capability allows a translator to add phrases to the pre-recorded list of phrases.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
3.5 Information Operations	US	3.5-345		Security concerns prevented the use of automated interfaces between the IFOR data networks.
There were no automated interfaces between the IFOR data networks (CRONOS, IARRCIS, and LOCE) and national networks. The CRONOS was not interfaced with LOCE or the ADAMS networks (some information was manually transferred between the systems). The main reason for this was security considerations. There were no approved secure guard gatewaysthat could accommodate an automated interface. The ADAMS movement control system and JOPES required a manual interface for exchanging information. U.S. intelligence processing systems used at echelons above corps (EAC) did not "talk" to the echelons at corps and below(ECB) systems. To address the problem, some EAC systems such as the U.S. Joint Deployable Intelligence Support System (JDISS) was deployed to ECB intelligence centers. There were no automated interfaces between the IFOR data networks (CRONOS, IARRCIS, and LOCE) and national networks.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.1 Logistics	US	4.1-129		Use of common fuel (i.e., JP8 - aviation grade) between aviation equipment and vehicles was beneficial.
All JP8 fuel obtained was aviation grade. This allowed the fuel to be interchanged between vehicles and aviation equipment. This was particularly useful in remote locations when a helicopter required refueling. The JP8 was aviation grade; however, if the fuel was tested and did not meet aviation standards then it was routinely used for vehicles. Fuel was successfully shared with the multi-nationals.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.1 Logistics	US	4.1-131		MHE interoperability: MLRS pod unloading shortfalls
UK materiel handling equipment (MHE) successfully loaded and unloaded NL vehicle FR MHE could not lift multi-launch rocket system (MLRS) pod. US heavy expanded mobility tactical truck (HEMTT) crane was capable of loading and offloading France, and by extension, any nation relying on French MHE to load/offload MLRS pods.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.1 Logistics	US	4.1-344		Some NATO countries require adapters to exchange fuel

The interoperability of Tactical Fuel Handling Equipment (TFHE) produced various results. The BE, NL & US are totally interoperable. All other operations between nations required some form of adapter. In the case of UK & US, operations could only be achieved with a combination of FR, GE and BE couplings. The GE had only one coupling for interoperability, therefore only one of their tankers can be considered interoperable at one time. While in some cases top loading could be employed, this carries some risk of static electricity discharge.
BFI to LF to BFI.
BE, US & NL were able to couple directly, FR required an adapter, which was made up using available adapters. FR, BE, US & NL TFHE are very similar and utilize the 3" CAMLOCK coupling system. GE & UK require adapters in order to pump in or receive fuel from the BFIs.
The interoperability of TFHE produced various results. The BE, NL & US are totally interoperable. All other operations between nations required some form of adapter. In the case of UK & US, operations could only be achieved with a combination of FR, GE and BE couplings. The GE had only one coupling for interoperability, therefore only one of their tankers can be considered interoperable at one time. Whilst in some cases top loading could be employed, this carries some risk of static electricity discharge. STANAG 3756
SF to SF.
The interoperability was generally good; however, limitations were couplings between UK & NL and UK & BE. The provision of an Avery-Hardol (F) and a 3" CAMLOCK (M) coupling would have facilitated interoperability. The BE SF has no top load capability due to its collapsible bag design. US & BE operations requires US SF to be connected through the pistol issue point which results in 5 gallon waste. US SF requires a bottom load capability. GE & UK, NL & US, NL & GE, FR & US and US & UK operations could be achieved by top fill only. The FR SF was equipped with an interoperability box, which allowed it to operate with all other nations. The GE SF has neither bonding nor a grounding-cable and this increases the risk from static electricity discharge. The NL LF model on the exercise was not equipped with a pump and can only supply fuel to those SFs or LFs which can 'suck' fuel or you deploy the NL LFT + SFT as a team. In could therefore not operate with either the US or BE. The UK could not refuel BE because neither has an adapter that appears to work. Both systems are new. The UK plus BE have not tested the interoperability of the tankers with each other. The specifications for both systems apparently did not include a requirement for interoperability with other NATO-countries equipment. The FR LF was equipped with an interoperability box, which allowed it to operate with all other nations.
LF to SF
In the main, interoperability was achieved but with some limitations. BE & NL, GE & FR, NL & FR, FR & NL, UK & FR, BE & GE, UK & NL, UK & GE, FR & UK, GE & UK operations were a success and utilized organic adapters. The stated limitation of the US SF meant that it had to be top loaded with the inherent risks. In FR & BE operations the FR fuel line retained fuel as the pump cannot suck and this must be removed to waste. GE & BE operations could only
BE large tanker to NL/US large tanker
Changes not required
GE large tanker to FR/NL/US/BE large tanker
Requires GE Bundeswehr adapter MK80 with 3" CAMLOCK coupling adapter. At the exercise there was only one GE adapter present for the 3 trucks sent to the exercise.
UK large tanker to US large tanker
The UK uses state of the art dry lock coupling (Avery-Hardol) which did not connect with the US large tanker without a series of different adapters from other nations. The UK apparently jumped ahead of the rest of NATO in technology. The cost of this adapter is approximately $300-$500 each.
UK large tanker to FR/GE/NL/BE large tanker.
Requires 3" CAMLOCK coupling adapter. But the POL Equipment WG has proposed a new adapter 3 ½ " Dry Brake coupling. The cost of this adapter is approximately 391 UK pounds.
FR large tanker to GE/BE/US/NL large tanker
Requires 3" CAMLOCK coupling adapter. But the POL Equipment WG has proposed a new adapter 3 ½ " Dry Brake coupling. The cost of this adapter is approximately 391 UK pounds.

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.2 Maintenance	US	4.2-118		Use of digital camera and internet helped to speed corrective maintenance action.

While operating in the Northern Bosnia area of operations a U.S. High Mobility Multi-purpose Wheeled Vehicle (HMMWV) was disabled due to a crushed brake line. The HMMWV was located in a United Kingdom controlled area. US maintenance officer inquired if the UK maintenance unit could make the repair since it was in their vicinity. The UK shop, however, was unable to repair the HMMWV since they do not stock HMMWV parts. The HMMWV was repaired when a US mechanic was flown to the site with the part and repaired the vehicle. The UK maintenance personnel emailed a picture of the damaged part over the internet, thus assuring that the US maintenance officer would have a clear understanding of the problem.

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.2 Maintenance	US	4.2-126		US Army Maintainers (Soldiers, US Civilian LARs, and Contractors) have constraints regarding repairing other nations equipment and issuing/receiving repair parts from them.
Commanders have to manage resources / end item missions based on the readiness of all the multinational end items. When a component fails on an end item from another nation, the foreign support associated with the end item is sometimes very limited. Arm Materiel Command-Europe Communications Electronics Command (CECOM) representative: Often the country has the skills to complete the repair, but the personnel are left behind in their country. Therefore, foreign countries ask Logistics assistance representatives (LARs) for help. If the foreign military sales (FMS) contract does not inducted USA support, then the USA LARs cannot legally provide maintenance support. This happened with the United Arab Emirates (UAE) Apache avionics. There are also other issues associated with providing Foreign Nations repair parts. 1st Armor Division logistics assistance officer (1AD LAO) representative: The countries do not have the capability to repair USA purchased equipment. This happens with the UAE Apache Avionics. The LARs could help, but charging the UAE for the maintenance time was very difficult. But more importantly, they must repair the item exactly the way the manual indicated, i.e. "By the Book", because fear of lawsuit in case something goes wrong after the repair. The LARs try to avoid completing repairs and provide guidance instead. There are supply issues associated with providing Foreign Nations repair parts. Current U.S. policy requires non-U.S. requesters to go through Foreign Military Sales for repair parts due to differing maintenance standards, problems with reimbursement, and the problems of accounting for the transaction by Department of Defense Activity Address Code (DODAAC).				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.2 Maintenance	US	4.2-229		The industrial gas fitting kit authorized in FSB maintenance does not include NATO (metric) fitting.
The standard industrial gas fitting kit authorized for welding and metal cutting required a local purchase of NATO metric fittings to enable use of gas containers provided during Operation Joint Endeavor.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.3 Storage and Supply	US	4.3-294		Fire extinguishers are not uniformly marked between nations.
Differences noted in equipment, specifically fire extinguishers, which in UK are color-coded but in Europe are marked with letters to denote type - irrespective of color.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.4 Transport	US	4.4-127		US Equipment is too large and/or heavy for other NATO Heavy Equipment Transporter (HETS) to transport.
(A) US, UK and Germany all have US HETS (success story). For example, UK carried the US marines' equipment downrange. (B) Other NATO nations (such as Turkey) cannot move Heavy/Large US equipment with their HETs. US carried Turks equipment, but Turks cannot carry US equipment.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.4 Transport	US	4.4-134		Palletized Load Systems (PLS) flat racks among NATO Nations are not interoperable.
The flat racks of the different NATO Nations PLS systems are not the same size. This generates a logistics nightmare. The U.S. PLS cannot pick-up the empty German PLS Flat Rack because the flat racks are different sizes. Therefore, PLS interoperability is limited and requires detailed transportation planning.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.4 Transport	US	4.4-135		Securing (tie-down) of non-palletized equipment being transported from railhead.
Restraint straps of US, GE, FR are not interchangeable.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.4 Transport	US	4.4-145		Rail transport required full loads (50 MILVANS (Military-Owned Demountable Container)) before shipment was allowed.
Task Force Eagle developed a unique ammunition distribution system for Operation Joint Guard. They used a combination of truck, air and rail assets. For the most part, ammunition distribution worked well. However, there were a few drawbacks. Eagle Express (a German trucking company) transported ammunition from Miesau, Germany, south to the ASP in Hungary. The company was made up of twelve German military drivers using the German M915 tractor-trailer. The turn-around time for shipping from Miesau to Hungary was 48 hours. The major problem associated with this mode of transport was that Eagle Express primarily delivered ammunition south. They did very little ammunition hauling on the return leg from the intermediate support base (ISB) to Germany. The railway system was used for ammunition movement north. The rail movement team (RMT) at the ISB arranged for rail transportation from the ISB back to Central Region. This was a viable means of transport but it took 50 milvans to fill the train. The RMT had to have a full order before the train was allowed to depart. Therefore, this transportation method was not very timely.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.4 Transport	US	4.4-233		There was no interoperable automated data processing system to support movements planning, information processing and production of specific movement documents.
Several nationally owned & generated tools were observed. These were not interoperable. Automated system(s) that can assist in the development of movement graphics, -plans, -situation reports, -credits & route timetables were felt to be very useful as a movement control tool.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.5 Medical Equipment	US	4.5-115		The dental equipment deployed during Operation Joint Endeavor was not dual voltage.
A medical brigade provided echelons above division medical support throughout the Operation Joint Endeavor (OJE) Theater. The medical brigade deployed a total of 20 units to provide medical support (16 of its own medical units, a medical unit from an infantry division. Two CO S medical units, and one Navy unit). Approximately 1,800 medical brigade soldiers were deployed.: The dental equipment deployed during Operation Joint Endeavor was not dual voltage. The electrical requirements for the dental equipment used during this deployment created numerous problems. The forward operating bases normally had electrical power provided by Brown and Root, usually 220V. Rarely did these bases have a 52D (power generation mechanic) that could support and maintain the 5 KW or 15 KW generators that the unit was frequently forced to use. The forward dental treatment teams attempted to solve the problem by obtaining transformers, often at personal expense, so that the provided 220 voltage could be used. This was only a temporary solution because it was difficult to obtain replacement fuses.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.5 Medical Equipment	US	4.5-147		Some medical supplies are not standard
U.S. medics found that some medical supplies provided by the UN were not in the American medical formulary, and some medical supply packaging was in languages other than English				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.5 Medical Equipment	US	4.5-148		Oxygen bottles had to be transported from Germany due to the inability to adapt to the local bulk storage tanks.
Oxygen needed for hospital operations had to be shipped in from Germany because the bottles could not adapt to fit the bulk storage container fittings that were available locally. Adding to the problem was the fact that the oxygen bottles are HAZMAT and couldn't be shipped via C-130. This meant they needed to be carried over the road. A group from the United Kingdom finally fashioned an adapter to solve the problem.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.7 Infrastructure	US	4.7-112		The NATO nations currently do not share Engineering/Bridge Building Asset information.
When a NATO operation begins, SHAPE identifies the requirements and writes a Statement of Requirement (SOR). SHAPE sends the SOR to NATO nations and each nation signs-up for part of the SOR. For example, maybe a SHAPE SOR is 5 (five) engineering battalions and the following nations sign-up: USA 1 Batt., UK 1 Batt., Hungary 2 Batt., and Italy 1 Batt. The type of equipment in each battalion is similar, but not exactly the same. For example, an Armored Vehicle Launched Bridge (AVLB) Launcher from the USA may use a M1 chassis and the UK may have a different chassis. But, the AVLB Launcher will complete the same mission. Different equipment is not the real problem. The problem is when one NATO nation requires help, due to equipment shortages; the procedure is for the nation lacking equipment to contact SHAPE, usually with 3-Star signature. SHAPE is supposed to determine which country has available equipment and requests the equipment for needed projects. However, SHAPE does not have a DB with all the NATO Engineering/Bridge equipment. Hence, when the USA needs an AVLB Bridge and launcher, SHAPE doesn't know which country can help. The lack of bridge asset visibility increases the time to receive other nation helps and the time to complete the projects. Partial Solution: The USAREUR-DCSENG started to collect NATO bridge assets to speed up the SHAPE process. But, the USA does not have authorization to collect data. Hence, other nations do not always provide the USA data and the data collection process is time consuming.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.7 Infrastructure	US	4.7-124		The US is the only country using JP8 as their primary fuel. Other NATO nations use Diesel fuel. JP-8 can be used as a substitute for diesel fuel; however, potential maintenance issues exist (e.g., clogged filters).
Head Quarters US Army Europe Deputy Chief of Staff of Logistics … JP8 fuel is a diesel fuel. JP8 fuel is considered better than diesel fuel because it has additives, which have anti-freeze properties, reduces volatility, and reduces wear and static. Going from a vehicle with JP8 fuel to Diesel fuel is acceptable. However, vehicles with diesel fuel cannot put JP8 fuel into the tank. If JP8 fuel is mixed into a tank of diesel fuel sludge is generated. Hence, fuel filter and injectors become clogged. Problem, often when on a mission, only diesel fuel is available. Hence, U.S. vehicle must add Diesel fuel to the JP8 which will eventually make the vehicle non-operable. Logistics Assistant Officer - Fifth (LAO – V) Corps Confirmed similar problems in Hungary.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.7 Infrastructure	US	4.7-245		The Balkans lacked a modern meteorological system and indigenous weather data was sparse.
Historically, weather has had a significant impact on military operations. The 7th Weather Squadron and US Army Europe (USAREUR) weather staff provided accurate, timely, and relevant weather intelligence. Since indigenous weather was not available the weather staffs used a German satellite communications weather broadcast system, and the amount of real-time useful weather data to the troops in the field was the best in the history of the U.S. military. This remote weather support required reliable communications to ensure climatologic data was received by supported units.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
4.8 Local Procurement and Contracting	US	4.8-246		Lack of central control of acquisition of products and services.
NATO and national acquisition of products and services for use in the IFOR operation was not strictly centrally controlled, so there were inconsistencies in costs, spares, support arrangements, training, and documentation. USAREUR (US Army Europe) did not coordinate its contracting with NAMSA (NATO Maintenance and Supply Agency), the NATO contracting authority in country; they used their own contracting officer. This required USAREUR contracting personnel to come from Germany and Hungary to accomplish the contracts mission when in-country NATO contracting officers could have accomplished the mission if an agreement with NATO had existed. There were few standing contracts to support contingency acquisitions. For example, at the outset DISA (Defense Information Systems Agency) had a contract in place for use of the commercial space segment (the CSCI contract for transponder leasing). However, there was no DISA or other contract vehicle in place for providing earth terminals and for the installation of other equipment such as IDNXs (Integrated Data Network Exchange), routers, and the O&M (Operations and maintenance) of installed equipment.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
5.1 Impact from Environment	US	5.1-136		Due to weather conditions the USA and other NATO countries cannot provide adequate support to deployed aircraft.
Background: When trying to establish base camps the mud was knee deep. For the most part, only 4-wheel drive vehicles could travel in the mud (HMMWVs could move in the mud). Helicopters were too heavy to land because they would sink. NATO did not have the type of structures to help the USA establish Aviation Support Structure. Also, maintenance on sophisticated aviation equipment was difficult because of the rain, mud, wind, particles in the air, etc. The USA requested NATO to help by providing Large Aviation Maintenance Shelters (LAMS) and AM2 Matting. AM2 Mats are large Aluminum plates that interlock and can be spread over the mud to create a large landing area. The LAMS are very large sturdy shelters for conducting aircraft maintenance. The US Army eventually received some LAMPs and AM2 matting from the US Air Force. But USA (not NATO) paid the bill. However, more are required if the USA and NATO wants better Aviation Capabilities.				

Sub-chapter	Country reporting	Lesson number	Classification	Title
5.1 Impact from Environment	US	5.1-321		Helicopters were frequently prevented from responding to emergencies due to snow and ice.
Presently, aviation units are using equipment not specifically designed to de-ice aircraft. Aviation task force used a clamshell tent to store its QRF aircraft during snowy periods to keep from having to de-ice the aircraft, which is a lengthy process. Presently, aviation units are using equipment not specifically designed to de-ice aircraft. Aviation task force used a clamshell tent to store its QRF aircraft during snowy periods to keep from having to de-ice the aircraft, which is a lengthy process. The aviation task force was required to provide a QRF of two AH-64s and one UH-60 to Multinational Division (North), with 1 hour notice to move. When snow accumulated on the helicopters, the unit would require two to three hours for two personnel with a Herman Nelson heater or Auxiliary Ground Power Unit (AGPU) to de-ice the aircraft for flight. This was not a satisfactory arrangement for QRF aircraft. By using the maintenance clamshell tents to store the QRF aircraft, the unit can meet its NTM requirements for the MND(N) QRF. However, due to the way that the aircraft must be positioned inside a maintenance clamshell tent, the unit requires 20-30 minutes to move the aircraft out of the storage area and into the flight line. This also impacted the Medical Company Air Ambulance (AA) and Command Aviation Section. These units shared a clamshell maintenance shelter. The Medical Company (AA) provided Medical Evacuation support for Multi-National Division North and Task Force Eagle. Icing of aircraft was common. Ice often prevented the unit from providing timely MEDEVAC coverage.				

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APPENDIX B – BALKANS GLOSSARY

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APPENDIX B - BALKANS GLOSSARY

10BaseT network	A local area network (LAN) configuration supported by unshielded twisted pair cables.
5th Wheel	A device used to connect a trailer to a tractor
A10	USAF aircraft designed specifically for close air support of ground forces
A2C2	Army Airspace Command and Control; main functions include the deconfliction of airspace between helicopters, jets, air defense units and artillery units
A2C2S	Army Airborne Command and Control System; a highly mobile tactical command post that enables the maneuver commander to maintain situational awareness and to exercise command and control while on the move
AA	Air Ambulance; an aircraft used for medical evacuation
AAR	After Action Review
ABCCC	Airborne Battlefield Command and Control Center; USAF EC-130E aircraft equipped with communications, data link, and display equipment
ABCS	Army Battle Command Systems; the digital Command, Control, Communications, Computers and Intelligence (C4I) systems that automate the digital force
ABCT	Airborne Battalion Combat Team
ABCT	Airborne Combat Team
ACE	Allied Command Europe. One of two major military commands of the North Atlantic Treaty Organization (the other is Allied Command Atlantic)
ACE	Analysis and Control Element; an intelligence organization whose mission is to focus collection resources and to produce and disseminate intelligence
ACE	Armored Combat Excavator
ACT	Analysis and Control Team; intelligence units that process all-source information using ASAS and similar systems
ADAMS	Allied Deployment and Movement System; an automated deployment and movement system with tracking capability; a decision support system for the assessment planning and coordination of NATO multinational force deployments
ADF	Automatic Direction Finder
ADOCS	Automated Deep Operations Coordination System; a LAN system for coordination, planning and execution of targeting, aviation routing, air control point selection and deep operations synchronization. ADOCS interfaces with Army C4I systems, and it displays situational graphics
AES	Aviation Electronic Systems
AFATDS	Advanced Field Artillery Tactical Data System; a fire support C2 system that processes fire missions and other related information to coordinate and optimize the use of fire support assets,
AFSOUTH	Allied Forces Southern Europe; one of the two Regional Commands of NATO's Allied Command Europe
AGM	Attack Guidance Matrix; a table, approved by the commander, which lists targets to be attacked, how, and when
AH	Attack helicopter
AH-64 Apache	The US Army's primary attack helicopter; the principal mission of the Apache is the destruction of high-value targets

AHR	Armed Helicopter Regiment
AI	Area of Interest; a geographical area from which the commander requires information and intelligence in order to execute successful tactical operations and to plan for future operations
Air Warrior	US combat training exercise for Army, Air Force, Marine and Navy
ALSE	Aviation Life Support Equipment; provides the best possible chance of survival in an accident and safeguards the health of the crew and passengers who travel in Army aircraft
Ammo	Ammunition
AM2 Matting	Aluminum plates that interlock and can be emplaced over mud to support paving
AMC	Army Materiel Command
AMPS	Air Mission Planning System; AH-64 pilots key flight plans into a computer cartridge that plugs into the Apache's electronics
AN/TTC-39D switch	A US Tri-Service Tactical Communications (TRI-TAC) central office telephone switch used at echelons above Corps. Capable of interfacing with NATO and commercial telephone switches.
Analog switching interface	Interface between two dissimilar telephone switches operating in analog mode
AO	Area of Operation; a three-dimensional volume prescribed by boundaries on the ground and the airspace above
AOI	Area of Interest
AOP-6(N)	A NATO handbook on ammunition
AOR	Area of Responsibility
AP	Armor piercing
APC	Armored Personnel Carrier
APS	Army Pre-positioned Stocks
ARCS	Aerial Rocket Control System; AH-64 pilot interface to the 2.75" rocket launcher
ARRC	ACE Rapid Reaction Corps
ASAM	Aviation Safety of Flight Message
ASAS	All Source Analysis System; a tactically deployable automated data processing system designed to support the management of intelligence and electronic warfare operations and target development
ASE	Aircraft Survivability Equipment
ASET	Aircraft Survivability Equipment Trainer; an array of mobile threat simulators intended to create a realistic threat environment for use in training U.S. Army aviation crews to operate and survive in such an environment
ASP	Ammunition Supply Point; a site, normally operated by a direct support ammunition company, which maintains a supply of high-volume munitions
Asset visibility	A term used to describe a field commander's knowledge of his supply quantity, condition and location
ASR	Air Support Request
ASTOR	Airborne Stand-Off Radar; UK ground surveillance system designed to provide information about the deployment and movement of enemy forces
ATACMS	Army Tactical Missile System; a long-range missile that receives guidance from the global positioning system and carries submunitions to a target
ATO	Air Tasking Order; the primary vehicle for disseminating the who, when and where of air operations

AUTODIN	Automatic Digital Network; a worldwide, high-speed, automatic, electronic, data communications system
AVCATT	Aviation Combined Arms Tactical Trainer; provides helicopter crews training in a high-intensity combat mission environment
AVENGER	A pedestal-mounted Stinger air defense missile designed to counter hostile cruise missiles, unmanned aerial vehicles, and low-flying, high-speed aircraft
Aviation grade fuel	Fuel suitable for aircraft engines
Aviation Support Structure	The organization, services and equipment provided to sustain aviation operations
AVIM	Aviation Intermediate Maintenance
Avionics	Aircraft electronics, including communications, navigation flight management systems, cockpit instrument displays, terrain awareness and warning systems, cockpit/ground communications data links, navigation position sensors, satellite communications, cabin information/entertainment systems and cockpit voice recorders
AVLB	Armored Vehicle Launched Bridge launcher; a vehicle, usually a tank chassis, equipped to carry and assist in the emplacement of a bridge section
AWACS	Airborne Warning and Control System
AWR	Airworthiness Release; a demonstrated capability of an aircraft or aircraft subsystem or component, including modifications, to function satisfactorily when used within prescribed limits
Ballistically tolerant	Jargon indicating ability to survive small bullets and fragments
Bandwidth	The amount of the radio frequency spectrum occupied by a radio signal
BASS blanket	Ballistic blanket floor cover used to protect helicopter crews from small arms and fragments
BCE	Battlefield Coordination Element; the primary point of contact for all preplanned tactical aircraft support requests
BDA	Battle Damage Assessment; an estimate of damage caused by a specific attack of a target
BDE	Brigade
BDI	Balkans Digitization Initiative; a HMMWV-mounted system that tracks vehicle position via GPS and transmits current position to a base camp. The base camp can then transmit, via email, any desired course correction.
BE	Belgium
BN	Battalion
BOA	Battlefield Ordnance Awareness sensor; developmental program for overhead detection and acquisition of firing weapons
Boresight kit	A measuring instrument that checks the alignment of a weapon's bore and the attached sight (aiming device)
BPSK	Binary Phase Shift Keying modulation; a common means of coding information on a radio signal by changing the phase of the signal by 180 degrees
Breaching	Getting through (i.e. a minefield or other barrier)
British EUROMUX switch	British tactical telephone switch, which is to replace the PTARMIGAN tactical switch.
Brown and Root	US contractor
C12	Airplane used for special missions
C2	Command and Control

C3I	Command, Control, Communications and Intelligence
C4I	Command, Control, Communications, Computers and Intelligence
CA	Canada
CAAT	Combined Arms Assessment Team; the primary active collection method used by the Center for Army Lessons Learned (CALL) to gather quality observations and provide lessons to the U. S. Army
Camelback	Back-carried water bladder
CAMLOCK	A device used in coupling a hose (e.g. fuel hose) to an outlet or inlet
CAOC	Combined Air Operations Center; plans operations and coordinates utilization of airspace by all aircraft and artillery
CATS	Combined Arms Training Strategies
CBT	Computer Based Training; US Army training programs
Camp Comanche	A camp used by TF Eagle; “the hub of flight operations in the Balkans,” responsible for aviation support throughout MND-N
Camp Dobol	A camp used by TF Eagle; east of Tuzla
CAOC	Combined Air Operations Center
CCD	Camouflage, concealment and deception; means used to reduce the effectiveness of attacking air and ground forces’ reconnaissance and target acquisition assets
CECOM	US Army Communications-Electronics Command
Central Region	Part of Allied Command Europe
CEG-E	Combat Equipment Group-Europe
CEOI	Communication Electronic Operating Instruction; the technical guidance required to establish and maintain communications in support of operations
CEV	Combat Engineer Vehicle
CH-47	US Army helicopter
Chem light	Small cylinder that emits soft light when the chemical contents are mixed
Chinook	US Army CH-47 helicopter
CINC	Commander-in-Chief
Circuit switching system	Tactical telephone switch
CIS	Combat Intelligence System
CJCCC	Combined Joint Communications Control Center
Class 60 bridging	A system of floating rafts and bridges. Class 60 equipment can support MLC 70 traffic in currents up to 8 feet per second
CMS	Combat Mission Simulator; provides training of experienced aviators in areas such as nap-of-the-earth flight, masking/unmasking, engagement techniques, weapons systems operation and aircraft survivability equipment
CNR	Combat Net Radio; tactical push-to-talk radio mainly used for voice communications. Comes in manpack, vehicular and airborne configurations
Co-channel interference	Interference resulting from two or more simultaneous transmissions on the same channel
COMINT	Communications Intelligence

Common Tables of Allowances	Equipment required in addition to current authorization
COMSEC	Communications Security; encryption devices that protect voice and data transmissions from being interpreted by unintended recipients
Condition code K ammunition	Ammunition received in unknown condition
Connectivity	Concept which describes the physical (radio or wire) adequacy of connections between nodes in a network
CONUS	Continental United States
Copperhead	Laser-guided artillery round
COTS	Commercial off the Shelf
CMCS	Countermine Capability Sets
CMs	Countermeasures; any method (e.g. deception, concealment, active attack) for reducing the effect(s) of enemy actions
CPG	Copilot Gunner
CRESO	Italian heliborne MTI radar
CRONOS	Crisis Response Operation NATO Open Systems
Crypto	Abbreviation for cryptological
Crypto re-key	Change crypto settings
CSH	Combat Support Hospital
CSS	Combat Service Support
NIU	NATO Interface Unit; card used to interface US tactical telephone switches with NATO telephone switches.
CYZ-10 devices	Data Transfer Devices; used to store and distribute cryptographic keys and Signal Operation Instructions from the Key Management Center to individual radios/soldiers
D+30	Thirty days after the start of operations
D7 Dozer	Large earth-mover
DA	Department of Army
DART	Downed Aircraft Recovery Team
DB	Data base
DCSENG	Deputy Chief of Staff, Engineers
DCSOPS	Deputy Chief of Staff, Operations
Deep Operations	Activities directed against opposing forces not in contact
Defense Security and Cooperation Agency	Manages foreign military sales
DEPMEDS	Deployable Medical System [tent]
DFCCO	Digital Force Coordination Cell; located at Fort Hood, and is coordinating actions across DTOLMS
Digital data group modem	Modem used on switched network trunk lines to condition the signals for transmission over multichannel or SATCOM radios
Digital switching interface	Interface between automated switches which use digital signaling
DISA	Defense Information Systems Agency

DME	Distance Measuring Equipment
DODAAC	Department of Defense Activity Address Code
DOOC	Deep Operations Coordination Cell
DOCC	Deep Operations Coordination Cell; corps organization responsible for synchronization of all aspects of deep operations according to the commander's guidance
DOD	Department of Defense
DPMO	Deployment Process Modernization Office; develops deployment business processes (doctrine, training, leadership, force structure, and information systems)
DRMO	Defense Reutilization and Marketing Office
DSCS	Defense Satellite Communications System
DSVT	Digital Secure Voice Terminal
DTC	Data Transfer Cartridge
DTD	Data Transfer Device; device used to load cryptographic keys into cryptographic equipment.
DTMF	Dual Tone Multi-Frequency; telephone signaling technique used by a subscriber phone terminal to inform the telephone switch of the requested phone number
DTOLMS	Doctrine, Organization, Training, Leader Development, Materiel and Soldiers
E-1 lines	Commercial European high speed data communications lines.
EAC	Echelons Above Corps
Eagle Base	A base camp used by TF Eagle
Eagle Express	Name assigned the activities of a German trucking company
EBS	Embedded Battle Command
ECB	Echelons at corps and below
EDS Military Systems	Military division of US contractor, Electronic Data Systems
EKG	Electrocardiograph
Emitter	Electronic system that produces radio frequency signals
Encryption	Scrambling information in a way that only an authorized recipient can unscramble it
EO/IR	Electro-optical/infrared; a sensor technology
EO/IR CM	Electro-optical/Infrared countermeasure device
E-OPS	Engineer Operations System; US electronic plotter that supports engineer activities; can produce map overlays
ERFS	Extended Range Fuel System
ETCO2	End Tidal CO_2, analysis of $ETCO_2$ and other exhaled gases is a standard medical practice
Exercise Heavy Lift / Clever Fix 1996	NATO training exercise
FAA	Federal Aviation Administration
FAC	Flight Activity Category; aviator proficiency level
FBCB2	Force 21 Battle Command, Brigade and Below

FMTV	Family of Medium Vehicles; new US Army 2 1/2 and 5 ton trucks
FAX	Facsimile transmitter/receiver
FCE	Fire Control Element
FCC	Fire Control Computer
FDS	Fire Direction System
Firefinder	US radar systems (TPQ-36 and TPQ-37) for locating and targeting the positions of indirect fire weapons
Flat rack	A structure, similar to a pallet, used to secure cargo on a truck bed
Flechette warhead	Warhead that contains small darts (flechettes)
FLIR	Forward-looking infrared sensor
FLTSAT	Fleet Satellite
FM	Field manual
FOMV	Family of Medium Vehicles; US program that is developing a new transport vehicle fleet
Force protection	Methods that enhance the survivability of own troops and equipment
Force Provider	A compilation of military and commercial products containing all the materiel necessary to provide climate-controlled billeting, quality food and dining facilities, hygiene services and morale, welfare & recreation facilities
FMS	Foreign military sales; US term that describes the process for selling weapons to other nations
FALCON	Forward Area Language Converter
FLIR	Forward-looking infrared
FR	France
FRA	Forward Repair Activity
Fratricide	Unintended killing of own troops or equipment
French Claw	A metal claw with attached lanyard, used to move mines off a road (before destroying the mines)
Frequency congestion	Demand for the use of more radio frequencies than are available
Frequency-hopping	Radio technique used to avoid enemy countermeasures
FRIES	Fast Rope Insertion and Extraction System
Front lifting shackle bracket	Device used to secure a shackle that attaches a lifting mechanism
FSB	Forward Support Battalion
FST	Forward Surgical Team
G-3	Intelligence staff officer
GA	Georgia
GATM	Global Air Traffic Management; a system that uses satellite-based communication, navigation, surveillance and air traffic management. The Federal Aviation Administration and the International Civil Aviation Organization, a special agency of the United Nations established GATM standards in order to keep air travel safe and effective in increasingly crowded worldwide air space.

GCCS-A	Global Command and Control System – Army; a single seamless Army command and control system, a component of the Army Battle Command System and the Army component of the joint Global Command and Control System
GE	Germany
Geotextile fabrics	In paving, the fabrics provide a means of maintaining the separation of sub-grades from clean base aggregate and prevent intermixing of graded aggregate, i.e. useful over muddy terrain
GLINT	Gated Laser Intensifier; tape used to mark own forces when illuminated by a laser
GOTs	Government Off-the-shelf equipment
GP	General Purpose
GPS	Global Positioning System
GRCS	Guardrail Common Sensor; an airborne electronic warfare system
Grafenwoehr	US Army training area near Nuremberg, Germany
Grizzly	US developmental engineer countermine system
GSM	Ground Station Module; a truck-mounted shelter staffed by a team of six Army personnel and consisting of a ground data terminal, a communications system, and an operations system. Together, these systems allow operators to manipulate data received from the Joint STARS aircraft.
GSR	Ground Surveillance Radar
HAP	Humanitarian Assistance Program
Happen-stance	Accident, coincidence, fluke, luck
HAZMAT	Hazardous material
HET	Heavy Equipment Transporter; tractor-trailer used to carry main battle tanks and similar large equipment
Hellfire	Helicopter-launched guided missile
HEMTT	Heavy Expanded Mobility Tactical Truck; the HEMTT comes in five configurations, designed for different combat-support missions. The M978 tanker refuels tactical vehicles and helicopters in forward locations. The M983 tractor tows the trailer-mounted Pershing and Patriot missile systems. The M984 recovery vehicle uses a lift-and-tow system to recover disabled vehicles. The M977 and M985 cargo trucks carry all types of equipment, especially ammunition. All but the tanker have optional material-handling cranes at the rear of the vehicle
HMMWV	High Mobility Multipurpose Wheeled Vehicle; a light tactical vehicle for command and control, special purpose shelter carriers, and special purpose weapons platforms
Hooah	(hoo ah) adj., adv., n., v., conj., interj., excla. [Orig. unknown] Slang. 1. Referring to or meaning anything and everything except "no". 2. What to say when at a loss for words. 3.a. Good copy. b. Roger. c. Solid copy. d. Good. e. Great. f. Message received. g. Understood. h. Acknowledged. 4.a. Glad to meet you. b. Welcome. 5. "All right!" 6.a. I don't know the answer, but I'll check on it. b. I haven't the foggiest idea. 7. I am not listening. 8. "That is enough of your drivel; sit down!" 9. Yes. 10. "You've got to be kidding me!" 11. Thank you. 12. Go to the next slide. 13. You've taken the correct action. 14. I don't know what that means, but I'm too embarrassed to ask for clarification. 15. Squared away (He's pretty hooah.) 16. Amen!
Horizon	French moving target indicator radar
HPTL	High Payoff Target List; a prioritized list of targets whose loss to the enemy will contribute to the success of the friendly forces
HQ ARRC	Headquarters ACE (Allied Command Europe) Rapid Reaction Corps

HQDA	Headquarters Department of Army
Hunter	US unmanned aerial vehicle
IARRCIS	Interim ARRC Information System
IDEP	Institutional Digital Education Plan
IDIP	Interim Digital Interface Ptarmigan; British prototype digital interface between PTARMIGAN and US Army MSE
IDP	Internally Displaced People
IDNX	Integrated Digital Network Exchange; an integrated packet/circuit switch that allows the integration of voice, data and video transmission applications using equipment from different vendors; multiplexes voice, data, and video onto multiple backbones
IFF	Identification Friend or Foe
IFOR	Implementation Force, charged with enforcing compliance with the Dayton Peace Accord
IFR	Instrument Flight Rules; rules that govern the procedures for conducting flight under instrument meteorological conditions (IMC)
IFSAS	Interim Fire Support Automated System
IMC	Instrument Meteorological Conditions; meteorological conditions defined by visibility, distance from clouds, and ceiling less than the minima specified for visual meteorological conditions. IMC is normally less than 3 mile visibility or less than 1000 foot cloud ceiling
INS	Inertial Navigation System
Infrastructure	Connections, means of communicating, including the communications and networking aspects of wide area, regional, or local networks; network transmission links; wireless and wired network access; personal communications systems; and internetworking of various types of networks
Inspiratory and expiratory inhalation agents	Agents that can pass through the respiratory system
INTSUM	Intelligence summary
INTEL	Abbreviation for intelligence (information)
Interchangeability	A condition which exists when two or more items possess such functional and physical characteristics as to be equivalent in performance and durability, and are capable of being exchanged one for the other without alteration of the items themselves, or of adjoining items, except for adjustment, and without selection for fit and performance
Interface	1. In a system, a shared boundary, i.e., the boundary between two subsystems or two devices. 2. A shared boundary between two functional units, defined by specific attributes, such as functional characteristics, common physical interconnection characteristics, and signal characteristics. 3. A point of communication between two or more processes, persons, or other physical entities. 4. A point of interconnection between user terminal equipment and commercial communications facilities. 5. To interconnect two or more entities at a common point or shared boundary.
Interoperability	The ability of systems, units, or forces to provide services to and accept services from other systems, units or forces and to use the services so exchanged to enable them to operate effectively together
In-transit visibility	Knowledge of the location of specific shipped materiel
Intubation	Clearing the airway
IOT&E	Initial Operational Test and Evaluation
IP network	Internet Protocol network; network layer protocol used for routing and delivery of messages over a packet network
IPF	Integrated Processing Facility; Ground processing center for Guardrail mission operations

IR jammer	Countermeasure to warhead with infrared guidance
ISB	Intermediate Support Base; an area located in the theater of operations, but out of direct fire range, so that force protection requirements are lessened. Commercial air and sea can flow to the ISB under reduced enemy threat and contractors can support the mission from a "safe haven" location. A place to build up stocks without having to constantly move them as the battle campaign progresses, and a place where theater or general support medical, maintenance, supply and administrative functions can be performed
ISDN	Integrated Services Digital Network; a system of digital phone connections that allows simultaneously voice and data transmissions. Data communications rate range from 128 KBPS to 1920 KBPS
JDISS	Joint Deployable Intelligence Support System
JDTC	Joint Development Training Center
JFCOM	Joint Forces Command
JMPS	Joint Mission Planning System
JOA	Joint Operations Area
JOC	Joint Operations Center
Joint Mission Area Analysis	Analyses of interest to joint services
Joint STARS	Joint Surveillance Target Attack Radar System; an Army and Air Force system designed to provide real-time surveillance, intelligence, targeting, and battlefield management information
JOPES	Joint Operation Planning and Execution. The integrated, joint, conventional command and control system used by the Joint Planning and Execution Community to conduct joint planning, execution, and monitoring activities
JP8	Aviation grade fuel, also used in most US ground vehicles
JROC	Joint Requirements Oversight Committee
JSEAD	Joint Suppression of Enemy Air Defenses
JTF-SH	Joint Task Force Shining Hope
JTRS	Joint Tactical Radio System; developmental tactic radio
JWICS	Joint World-Wide Intelligence Communication System
Karst	Topography in which the landscape is largely shaped by the dissolving action of water on carbonate bedrock. This geological process results in features ranging from sinkholes, vertical shafts, disappearing streams, and springs, to complex underground drainage systems and caves
KFOR	Kosovo Forces
KFOR secret net	A coalition secret communications network
Kingpin	Anchor pin at the center of a semitrailer's upper coupler, which is captured by the locking jaws of a tractor's fifth wheel to attach the tractor to the semitrailer
KOK 16	Communications security equipment
LAMS	Large Aviation Maintenance Shelters
LAN	Local Area Network; a computer network that spans a relatively small area, such as a building or group of buildings
LAN/WAN	Local Area Network/Wide Area Network
LANDCENT RMA	NATO's Allied Land Forces Central Europe

Landline	Wire communications lines
Landsat	Earth observation satellite
LAO	Logistics Assistance Officer
LAR	Logistics Assistance Representative
LAR	Logistics Aviation Representative
LAW	Light Antitank Weapon
LENS	
LEVEL ONE Rapid Transfuser	Blood transfer device
LIFEPAK 10	Defibrillator/Monitor/Pacemaker
Longbow	Improved version of the AH-64 Apache
LOS	Line-of-Sight
LOCE	Linked Operations-Intelligence Centers Europe; provides the United States European Command and other national allied military organizations with near-real-time, correlated situation, and Order of Battle Information for threat analysis, collection management cueing, indications and warning, as well as target recommendations.
LRS	Long Range Surveillance
LRUs	Line Replaceable Units
LSE	Logistics Support Element
LSA	Life Support Area; a secure area where soldiers are provided hot meals, recreation and other amenities
M1	US Army main battle tank
M1 Abrams	US Army main battle tank
M2/M3 Bradley	US Army armored personnel carrier
M915	5-ton capacity tractor-trailer cargo truck
M936 recovery vehicle	5-ton, 6x6, wrecker truck with winch
MACOM	Major command
MANPADS	Man portable air defense system
MASH	Mobile Army Surgical Hospital
Mass Casualty (MASCAL) Exercise	Military training exercise simulating the evacuation of combat casualties.
MEDEVAC	Medical Evacuation
MHE	Materials Handling Equipment
Maximum engagement envelope	Region within which an air defense weapon can hit a target
MCAPs	Mine Clearing Armor Protection kits
MCLIC	Mine Clearing Line Charge
MCS	Maneuver Control System
MEDEVAC	Medical Evacuation
Medical formulary	A program of objective evaluation, selection, and use of medicinal agents

MHE	Materiel handling equipment, e.g. fork lift, crane
MICLIC	Mine-clearing line charge
Microsoft Mail server network	Email network based on Microsoft Mail products.
MIDB	Military Intelligence Data Base
MILVAN	Military Van
Mini-flail	A small unmanned anti-personnel mine clearing system; a series of chains that rotate and beat the ground -- to detonate mines
MK-19 Grenade Launcher	A fully automatic weapon that fires 40mm grenades; the grenade can penetrate two inches of armor.
MLC	Military Load Class
MLRS	Multiple Launch Rocket System
MND(N)	Multinational Division (North)
MOD	Model; Ministry of Defense
MP	Military Police; Mentor-Protégé
MPSM	Multipurpose Submunition
Motorola LST-5E	Lightweight ultra high frequency satellite transceiver
Motorola XTS-3000 radio	Hand-held portable voice radio used in dismounted operations.
MOUT	Military Operations in Urban Terrain
MRE	Mission Rehearsal Exercise
MRT	Mobile Radio Telephone
MSC	Message Switch Center; digital data communications switch capable of accepting and routing record traffic to its intended destination.
MSE	Mobile Subscriber Equipment; US tactical telephone switching system capable of transmitting voice and data among subscribers. Also supports a packet network among automated systems from brigade through corps echelons.
MSRT	Mobile Subscriber Radiotelephone Terminal
MTI	Moving Target Indicator
MTMC	Military Traffic Management Command
MTOE	Modification Table of Organization and Equipment
Myocardial	Of the heart
NACOSA	NATO Communication and Information systems Operating and Support Activity; NATO activity responsible for managing, operating and controlling the Communications and Information System (CIS) and installations assigned to it
NAI	NATO Analog Interface; an analog communications interface between different NATO nation communications systems.
NAMSA	NATO Maintenance and Supply Agency
Nap-of-the-earth	Very low altitude (flight) that follows terrain elevation changes
NATO	North Atlantic Treaty Organization

NBC	Nuclear, Biological and Chemical
NDS-2	Night Driving System on the Fox NBC Reconnaissance vehicle
NES	Network Encryption System
NIMROD	UK airborne reconnaissance and electronic intelligence sensor system
NIMTAS	A night target acquisition system
NIPRNET	Non-secure Internet Protocol Router Network.
NL	The Netherlands
NLOS	Non-Line-of-Sight
NOD	Night Observation Device
Non-lethal systems	Weapon systems that are explicitly designed and primarily employed so as to incapacitate personnel or materiel, while minimizing fatalities, permanent injury to personnel, and undesired damage to property and the environment
Non-mission capable	Materiel damaged to the extent that it cannot be used as intended
NGB	Nose gearbox (Apache line replaceable unit)
NOTAMS	Notice to Airmen and Sailors, e.g. flight restrictions
NPT	Network Planning Tool; US Army system used to plan tactical circuit switched communications networks.
NRZ	Non-return to zero; signal coding scheme to allow two devices to communicate over wire links.
NSE	National Support Element
NTM	Notice to Move; an alert order that specifies a time when deployment may occur
NVESD	US Night Vision and Electronic Sensors Directorate of the Communications-Electronics Command
O&M	Operations and Maintenance
OH-58	Two-place single engine armed reconnaissance helicopter
OJE	Operation Joint Endeavor; NATO and PfP peacekeeping deployment December 1995 – December 1996
OJG	Operation Joint Guard; NATO and PfP peacekeeping deployment December 1996 – June 1998
Omni-4 tubes	Sensor in night vision goggles
Operation Allied Force	Contingency response, with air operations starting on 24 March 1999, aimed at ensuring full compliance with UN Security Council Resolution 1199 (Sept. 23rd 1998).
Operational Readiness	A somewhat subjective and contradictive assessment of capability; “to have a highly trained and ready personnel (operational), exercises must be frequent and realistic. Unfortunately, a heavy exercise schedule uses up equipment stocks and spares decreasing equipment (structural) readiness.” “The relation between available time and needed capability.” ……Richard K. Betts
ORD	Operational Requirement Document; the ORD identifies the performance necessary to satisfy the mission need
OTAD	Over-the-air-distribution; electronic means of distributing crypto keys and signal operating instructions over communications systems.
PADS	Position and Azimuth Determining System; a vehicular-mounted, inertial guidance system that provides three-dimensional position

	information (coordinates, elevation, and azimuth)
PAH	Position Area Hazard
Panther	Robot mine-clearing system
Patriot	A long-range, high altitude, all-weather air defense system to counter tactical ballistic missiles, cruise missiles and advanced aircraft
PfP	Partnership for Peace; the basis for practical security cooperation between NATO and individual Partner countries
PHOTO-TELESIS	System that transmits photo images from air to ground
Pintle	An assembly used to facilitate the towing of one vehicle by another
PLGR	Precision Lightweight GPS Receiver; hand-held global positioning system (GPS) receiver
PLS	Palletized Load System; a five axle 10x10 all-wheel drive truck and trailer system with a 33 ton payload capability designed for combat support, including the distribution and resupply of ammunition from the corps area forward
PM AES	Project Manager (US) for Aviation Electronic Systems
PM Apache	Project Manager (US) for the AH-64 attack helicopter
PMC	Partially mission capable
PM MCD	Project Manager (US) for Mines, Countermine, and Demolitions
PM MILSATCOM	Project Manager (US) for military satellite communications systems.
POMCUS	Positioned Overseas Material Configured to Unit Sets
POP-3	Post Office Protocol 3. A protocol used to send and retrieve email from a mail server.
Power Scene	Terrain visualization software
PRC-127	Hand-held tactical radio
Predator	Unmanned aerial vehicle
Propaq monitor	Vital Sign monitoring device (medical)
PTARMIGAN	UK communications equipment for multiple subscribers
PTWS	Point Target Weapon System
QPSK modulation	Quadraphase-Shift Keying modulation; a type of phase shift modulation used in communications systems.
QRF aircraft	Quick Reaction Force aircraft
Ramstein	Location of US military installation in Germany
RAP	Rapid Audio Phase; audio processing and translating equipment
RBECS	Revised Battlefield Electronic CEOI System; US Army system used to generate frequency allocation tables and signal operating instructions for US and NATO communications systems.
RC-12	Reconnaissance aircraft
REMBASS	Remotely Monitored Battlefield Sensor System
Reachback circuits	Circuits used to connect local (i.e. Balkans) communications networks with NATO and world-wide networks.

RETRANS	Retransmission Station; radio relay stations used to extend the communications ranges of a network.
RF	Radio Frequency
RGM	Respiratory Gas Monitor
Ribbon bridge	An interconnecting system of floating bridge sections, consisting of ramps and pontoons
Rivet Joint	Airborne electronic surveillance system
RMA	Return Materials Authorization; a manufacturer's agreement to accept the return of a specific product (usually due to a defect)
RMT	Rail Movement (Control) Team – coordinates rail scheduling and loading
ROC-V	Recognition of Combat Vehicles; software for training FLIR operators to recognize and identify targets
ROTAPRINT	UK truck-mounted printing press
RSIL	Recommended Support Item List
Rules of Engagement (ROE)	A set of constraints, *apart from the right to self defense,* that limit the employment of weapons, including the aiming of weapons. Constraints may extend to overflight, and to the employment of surveillance and target acquisition devices, to the use of deception, to unit proximity to an "opposing" unit, geographical boundary or restricted area, and to the evacuation, harassment or detention of civilians or their property.
SAIC	Science Applications International Corporation; US contractor
SATCOM	Satellite Communications
SAW	Squad Automatic Weapon
SCI	Sensitive Compartmented Information; information which requires a special need-to-know for access
SC TACSAT	Single Channel Tactical Satellite
SEMA	Special Electronic Mission Aircraft
SEN	Small Extension Node, a component of Mobile Subscriber Equipment
SFOR	Stabilization Force, charged with maintaining the Dayton Peace Accord
Shackle	Device used to lock a lifting mechanism to the object that is to be lifted, e.g. a truck's front end, prior to towing
SHAPE	Supreme Headquarters Allied Powers Europe
SHF TACSAT network	Super High Frequency Defense Satellite Communications System satellite communications system.
SIGINT	Signals Intelligence
Signal Operating Instructions (SOI)	Technical and operational information about a communications net which defines such parameters such as net frequency, call signs, etc.
SIIRCM	Suite of Integrated Infrared Countermeasures
SINCGARS	Single Channel Ground and Airborne Radio System; US Army combat net radio.
SIPRNET	Secret Internet Protocol Router Network; secure internet capable of transmitting and receiving classified information.
SIRFC	Suite of Integrated Radio Frequency Countermeasures
SISU	Swedish Army, Finnish-made 6x6 wheeled APC

SJA	Staff Judge Advocate
SMTP	Simple Mail Transport Protocol; email protocol.
SOF	Special Operations Forces
SOI	Signal Operation Instructions
Soldier System Command	Former name of the US Army Soldier Systems Center
SOP	Standing Operating Procedures
SOR	Statement of Requirement
SOTM	SATCOM On The Move; concept that allows communications via satellite while moving.
SPIES	Special Patrol Infiltration Exfiltration System
SPIRIT	Special Purpose Intelligence Remote Integrated Terminal
SSA	Supply Support Activity
Stability and Support Operations	Stability operations include such activities as peace operations, noncombatant evacuation, and foreign internal defense. Support operations respond to disaster and domestic crises, normally in support of civil authorities.
STAMIS	Standard Army Management Information Systems
STANAG	Standardization Agreement
STANAG 5040 6 wire ENM interface	NATO interface standard for tactical communications switches
STU-IIB	Secure Telephone Unit, NATO version.
STU-III	Secure Telephone Unit, US Government version.
Switch trunk group	Communications link between trunk switches in a voice network
TACAN	Tactical Air Navigation
TACIPRINT	Tactical Information Prints; a UK truck-mounted printing press, called a ROTAPRINT, a single-color mechanical printer, and associated peripheral equipment are used to produce TACIPRINTs
TACMIS	Tactical Management Information Systems
TACSAT	Tactical Satellite (for communications)
Tactical circuit/message switch	Automatic telephone switch used to connect voice and data subscribers
Tactical switched network	A network of switches used to connect voice subscribers in a tactical area.
Tactical switch/packet/message network	A network of switches used to connect voice, data, and message/record subscribers in a tactical area.
TADCOM	A Norwegian mobile communication system that provides high speed radio and telephone links for the brigade and division
TADS	Target Acquisition Designation Sight
TAH	Target Area Hazard
Talkabout radio	Small, non-secure, commercial, handheld voice radio
TARE	NATO message network.
TBO	Time Between Overhaul
TCN	Transportation Control Numbers

TF 1-26	US Task Force with headquarters at Camp Dobol
TF E	Task Force Eagle
TF F	Task Force Falcon
TF H	Task Force Hawk
TFHE	Tactical Fuel Handling Equipment
TF 2-121	A quick reaction/security force assigned to Multi National Division (North)
Thermal sight	Sensor, with aiming capability, that detects temperature differences
ThinNet (10Base2) LAN network	A local area network (LAN) configuration supported by unshielded twisted pair cables
Tier III maintenance	Maintenance of user level COTS equipment
Title 10	United States Code that requires the Army to perform the functions that organize, train and equip forces capable of accomplishing missions as a component of a unified command
TM	Technical Manual
TNOC	Theater Network Operations Center
TOA	Table of Allowances; an authorization document under which commanders may acquire clothing and individual equipment, field and garrison furnishings and equipment, or medical or non-medical expendable and durable items.
TO&E	Table of Organization and Equipment
TOC	Tactical Operations Center
TOPSCENE	Tactical Operational Scene; TOPSCENE systems support mission preview, mission planning mission rehearsal and mission training.
TOW2A	US antitank missile
TPFDD	Time Phased Force Deployment Data
TPN	Tactical Packet Network
TRADOC	Training and Doctrine Command
TRANSCOM	Transportation Command
Transfuses	(Medical) transfers blood component
TSS	Target Selection Standards
TRANSEC	Transmission security; measures designed to protect radio transmissions from interception and exploitation
TRI-TAC	Tri-Service Tactical Communications; Joint US Forces tactical circuit/packet/message switching systems at echelons corps and above
TRW	US contractor.
TTPs	Tactics Techniques and Procedures
	Tactics - The art and science of employing available means to win battles and engagements.
	Techniques - The methods used by troops and/or commanders to perform assigned missions and functions, specifically, the method of employing equipment and personnel.

	Procedures - The standard and detailed course of action that describe how to perform a task.
TTC-39D	US Central Office telephone switch.
Tunneling	A technology that enables one network to send its data via another network's connections
TWI	Through-the-Wall Imaging system
UAE	United Arab Emirates
UAV	Unmanned Aerial Vehicle
UGV	Unmanned Ground Vehicle
UH-60	US Army's front-line utility helicopter used for air assault, air cavalry, and aeromedical evacuation
UHF	Ultra High Frequency; Frequency range from 300 MHZ to 3 GHZ.
UIC	Unit Identification Codes
UK	United Kingdom
UK Task Force Cambria	UK Battle Group with Scandinavian support
ULLS	Unit Level Logistics System
ULN	Unit line number
UPS	Uninterruptible power supply
Unattended ground sensor	A sensor (e.g. acoustic, seismic) system that transmits sensings from a remote (unattended) location
Unbalanced condition diphase interface	Signal coding scheme to allow two devices to communicate over wire links
UNIX	A computer operating system
UNMIK	United Nations Mission in Kosovo
UNPROFOR	United Nations Provisionary Force
Unserviceable	Waste, e.g. damaged military munitions
US	United States
USAAVNC	US Army Aviation Center
USAREUR	US Army Europe
UTP	Unshielded Twisted Pair network; same as 10BaseT network
V Corp	US Army corps with headquarters in Germany
VHF	Very High Frequency; frequency range from 30 MHz to 300 MHz.
VMC	Visual Meteorological Conditions
VSAT	Very Small Aperture Terminal; a small satellite terminal that can be used for two-way communications via commercial satellites.
VTC	Video Teleconference
Warfighter	US training exercises
WARSAW Pact	Federation of the former Soviet Union and six other communist countries
WAN	Wide Area Network

Zero-velocity correction	Update of instrument (e.g. location) while stationary
ZODIAK	Zone digital automatic crypto secured; the Netherlands' automated tactical radio relay/telephone system that serves all HQs from corps to brigade
ZOS	Zone of Separation
ZSU-23-4	23mm self-propelled antiaircraft gun

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